THE

# DENTAL PRACTITIONER

*A monthly journal for the Practitioner and his Staff*

VOL. I, NO. 6 FEBRUARY, 1951

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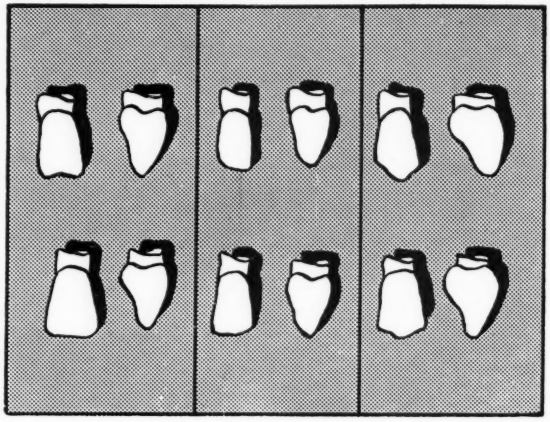

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# THE DENTAL PRACTITIONER

***A Monthly Journal for the Practitioner and his Staff***

*(Incorporating the Proceedings of the British Society of Periodontology)*

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# THE DENTAL PRACTITIONER

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Vol. I, No. 6 February, 1951

*ITORIAL*

## SPECIAL WELCOMES

We are sure that all British readers will wish to join us in extending a welcome to the now numerous friends The Dental Practitioner has made in Norway, Sweden, and Denmark. So to our Scandinavian readers we send our heartiest greetings; we hope you will continue to enjoy this monthly journal and that from time to time you will honour us with articles and information of interest to us all.

Our second welcome is to the British Society of Periodontology, which since its foundation in July, 1949, has already doubled its original membership and has carried out a successful first year's programme. Commencing with this number, we shall regularly be including the Proceedings of the Society. We feel sure readers will wish the new journal and the new society a long-continued association.

### THE PRESENT NUMBER

Guy's Hospital are the main contributors on this occasion and we are sure that no one will deny that they have indeed provided us with excellent material. To them we offer our most grateful thanks.

The considerable success so far achieved has in very great measure been due to the splendid help so readily given by the staffs of the various dental schools, and we unhesitatingly acknowledge our indebtedness to them for their invaluable contributions.

### THAT PROBLEM CASE

It has been suggested to us by several readers that we should publish details of "problematical, unusual, or difficult cases" met with by our readers, so that discussion can be entered into and the views of experts solicited and made known. We like the idea, but its success depends on YOU. Do not be ashamed to admit that you don't know *all* the answers, and accordingly do not hesitate to send us details (X-rays, if any, photographs of models, or even just the models or a sketch) relating to your problem case. If YOU supply the material we will do all we can to make this feature successful. As we have said before, this is your journal; let us get together and produce the material you want in the way that you want.

# PERIODONTOSIS: A REVIEW

By **R. D. EMSLIE**, F.D.S. R.C.S. Eng., B.D.S. Lond., M.S. Illinois.

*Head of the Department of Preventive Dentistry, Guy's Hospital*

PERIODONTOSIS is a degenerative disease of the periodontal tissues manifesting itself in changes that take place in the connective tissue of the periodontal membrane, and resulting in loss of the alveolar bone and pathological drifting of the teeth. Inflammation is not a primary aetiological factor, but by the time most cases are recognized clinically they are complicated by a secondary inflammatory reaction and the development of deep pockets.

Very few early cases are thus observed in which the primary picture has not been obscured by secondary processes. The few which have been described in the literature have been chance findings in sections of jaws obtained from autopsy specimens, with no dental history available. In fact, so little evidence has been produced in the twenty-nine years since the condition was first described that many periodontists do not yet recognize that the condition exists, but consider that the changes are the result of inflammation or trauma in tissues of lowered resistance.

## HISTORICAL SURVEY

The first description of a non-inflammatory type of periodontal disease was published in 1920 by Gottlieb. This condition he termed "diffuse atrophy of the alveolar bone" (1923), and claimed that atrophy of the alveolar bone and widening of the periodontal membrane were the chief characteristics of the disease.

*Fig.* 1.—Advanced periodontosis. The patient, a female aged 26 years, complained that $\underline{1}$ was protruding from the bite, and that all the teeth were becoming loose. The gingival margins appeared to be slightly inflamed, but no calculus was found in the deep but irregular pockets.

Resorption of the cementum might also occur, but, clinically, the earliest sign was usually migration of the affected teeth. The first case which he described was in an individual who had suffered from epidemic influenza, and he suggested that such a systemic disturbance might be an important aetiological factor.

Box in 1924 described "a chronic and progressive lesion of the pericementum which results in the rarefaction and destruction of alveolar bone". This condition he termed "rarefying pericementitis fibrosa", and the histopathological changes he described resembled in many ways those of Gottlieb's "diffuse atrophy". However, he maintained

that these changes occurred "during the progress of a very low grade of chronic inflammation". This bore no relation to any inflammatory changes in the gingiva. He blamed "overstress" as a cause of this pericementitis fibrosa, but suggested that other unknown factors might be involved.

Since then only a few cases in early stages of the disease have been described, but many descriptions of later stages of the disease, under such headings as "complex periodontitis", may be found.

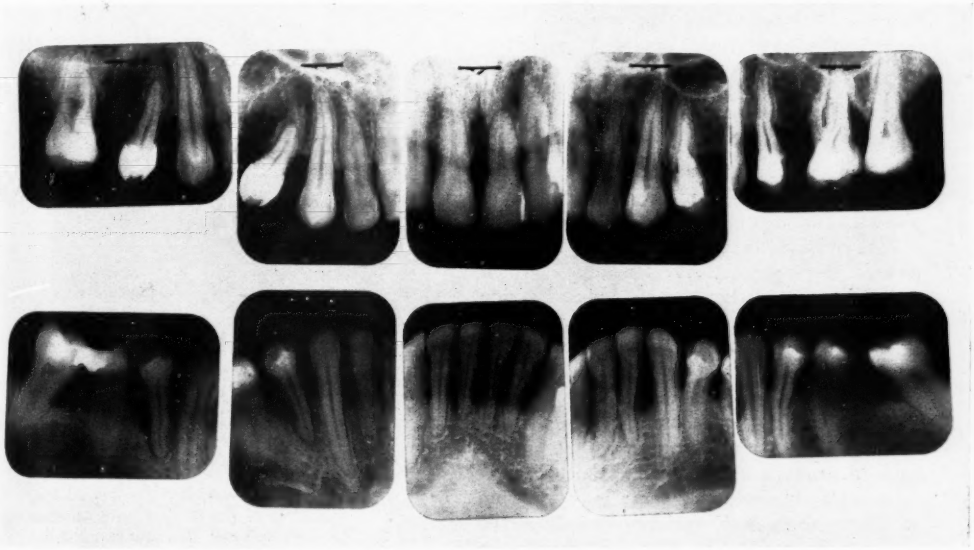

*Fig.* 2.—X-rays of the case shown in *Fig.* 1. The bone loss is irregular as a result of the "vertical" bone resorption around certain teeth.

## INCIDENCE

Periodontosis seems to be a disease of youth or early middle life. It may be found in the adolescent period during the years from 14 to 20, but is more prevalent between 20 and 40. Although considered to be a comparatively rare condition, its true incidence is not easy to assess, owing to the difficulty of diagnosis. No studies on its prevalence rate were discovered in the literature.

Various investigators have noted that the disease appears to show a predilection for the female sex, but no statistics on this could be found. One's clinical impression is that in the earlier age groups, at least 5 to 10 females present themselves for treatment of this condition to every male seeking treatment.

## CLINICAL PICTURE

**Migration of Teeth.**—Migration of the teeth may be the earliest sign of the disease, occurring before any obvious loosening or the development of pockets. Single teeth, groups of teeth, or all the teeth in both jaws may be affected, but the teeth most often involved are the upper incisors and upper and lower first molars. Owing to shifting their position the teeth may actually move into traumatic occlusion. In the incisor region, the migration may be accompanied by elongation of the teeth and spacing.

**Loosening of Teeth.**—The migration is followed, or accompanied, by a loosening of the teeth (*Fig.* 1). This loosening is often aggravated by trauma due to cuspal interference of the shifting teeth. In some cases, where the teeth do not move, the loosening is the first sign of the disease.

**Pocket Formation.**—Pocket formation, once it starts, seems to progress rapidly, probably due to sudden detachment of the proliferating epithelial attachment from the tooth surface.

**Gingival Inflammation.**—Not until pockets have formed, producing stagnation areas and subsequent infection, does gingival inflammation become clinically apparent. This may be difficult to recognize on casual examination, the gingival inflammation being greatest in the zone surrounding the pocket. Most investigators have noted that the disease often occurs in mouths which are well cared for, presenting what at first sight seem healthy, if pale, gingivæ. Examination with a probe will reveal deep pockets, often confined to one side of the tooth. Pressure on the gingiva will usually express pus or materia alba from the pocket.

X-ray examination at this stage will reveal an irregular and hazy alveolar margin, which may show much destruction of bone on one side of a tooth, but appear almost normal on the other side (*Fig.* 2). In the upper incisor region, the deep pocket may be often found on the palatal side. The periodontal membrane line on the X-ray may appear wider than normal.

Percussion of a tooth with periodontosis is said to produce a dull sound. Calculus may be completely absent, or there may be some of the subgingival variety encircling the neck of the tooth. In the early stages the bottom of the pocket may contain no calculus.

Pain is not a feature of the disease, but when the roots of the teeth have become exposed, or considerable occlusal trauma is being produced on the loosening teeth, or a periodontal abscess has developed, the patient may seek treatment for this symptom.

A striking feature of mouths with periodontosis is an immunity to caries. A few fillings may be present, but active caries is a rare finding. The significance of this fact is not clear, although several theories have been advanced.

## HISTOPATHOLOGY

The histopathology of periodontosis has been described by Orban and Weinmann in 1942 as follows:—

"In the *first stage* degeneration of the principal fibres of the periodontal membrane occurs with a localized widening of the periodontal membrane, due to resorption of the alveolar bone. During this process a proliferation of the capillaries can be observed with development of a loose connective tissue. There is no inflammation in this stage and no proliferation of the epithelial attachment.

*Fig.* 3.—First stage of periodontosis. The periodontal membrane is destroyed in a circumscribed area, and the space widened. Disorganized bundles of fibres extend into the narrow spaces of the bone. The shallow pockets and slight degree of inflammation should be noted. (*Photomicrograph by courtesy of B. Orban.*)

"The *second stage* is characterized by the proliferation of the epithelial attachment along the root surface. During this period there is slight cellular infiltration in the connective tissue. These scattered cellular elements are of the plasma cell and polyblast type.

"In the *third stage* the epithelium of the proliferated attachment separates from the surface of the root, and deep gingival crevices develop. The inflammation increases due to irritation and infection from these deep crevices."

**First Stage** (*Fig.* 3).—The changes in the periodontal membrane show first as a disorganization of the principal fibres, which may be localized to a small area, or include the greater part of the tooth socket. In Gottlieb's case (1923), the disturbance seemed to start at the apex of the teeth. Other areas described have shown the early lesion nearer to the alveolar crest. In the region of the lesion the fibres appear to be unattached at either the bone or the cementum end. Between these, bundles of fibres, showing signs of hydropic degeneration and no definite orientation, are found. Some of the fibres may show a type of granular destruction. Orban and Weinmann (1942) point out that similar degenerative changes have been described in tendons and ligaments.

Osteoclastic resorption of the bone of the socket opens up marrow spaces, which become filled with a loose fibrous tissue with numerous capillaries instead of the normal fatty marrow. Resorption of the cementum and dentine may also be found.

It is interesting to note that when the teeth migrate they appear to move *away from the side of the lesion*. This has been attributed to pressure from œdema or granulation tissue, or proliferation of connective tissue, on the affected side.

*Fig.* 4.—Second stage of periodontosis. The epithelial attachment of the tooth on the left has migrated apically as far as an area of resorption of the root. Little detachment of this epithelium has occurred and the pocket depth is still minimal. (*Photomicrograph by courtesy of B. Orban.*)

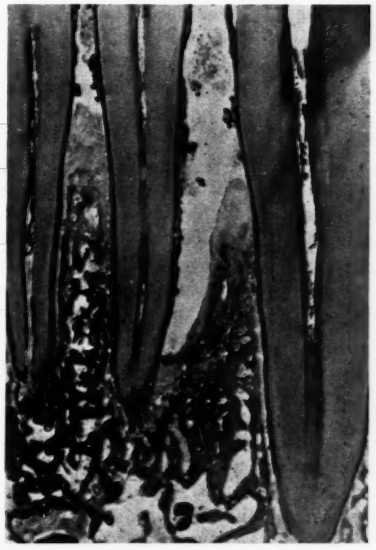

*Fig.* 5.—Third stage of periodontosis. The epithelium has separated from the tooth surface, producing a deep pocket. The picture is now that of periodontitis complex. (*Photomicrograph by courtesy of B. Orban.*)

If, for any reason, the factors causing the condition cease to operate at this stage, complete repair is possible, new bone and cementum being laid down and fresh principal fibres appearing.

**Second Stage** (*Fig.* 4).—The downgrowth of the epithelial attachment along the cementum may be associated with a proliferation of the epithelial remnants in the periodontal membrane. The inflammation which appears at this stage is explained by the penetration of toxins from the gingival crevice. Both the first and second stages are said to be of short

duration, but complete repair of the second stage is not possible.

**Third Stage** (*Fig.* 5).—With the development of the deep pockets and gross inflammation, the primary pathological condition is aggravated. Large portions of the supporting tissues are destroyed and even normal occlusal forces cause secondary traumatic changes. Clinically, cases of periodontosis are most frequently observed during the third stage, when they have become periodontitis complex.

## EXPERIMENTAL PRODUCTION OF PERIODONTOSIS

**Nutritional Deficiencies.**—Lesions resembling periodontosis have been produced in experimental animals on deficient diets. These we will consider under the headings of the food factors which were deficient in the diets.

*Vitamin C.*—Boyle, Bessey, and Wolbach (1937) produced periodontal disease in guinea-pigs on a diet free from vitamin C, supplemented with measured amounts of ascorbic acid. As a result of their findings they stated, "The essential characteristics of ascorbic acid deficiency and of diffuse alveolar bone atrophy pyorrhœa are identical, and may be summarized as an inability of bone and connective tissue to withstand functional stress". Previously, it had been noted by Wolbach and Howe (1926) that a deficiency in vitamin C causes "an inability of the supporting tissues to produce and maintain intercellular substances". In a later paper, Boyle (1938) stated, "Vitamin-C deficiency is the only nutritional deficiency which, in our experience, produces the characteristic features of the systemic type of pyorrhœa in experimental animals". But in this connexion it should be noted that the usual laboratory animals, with the exception of the guinea-pig and the primates, have the power to synthesize vitamin C and are not susceptible to scurvy induced by experimental dieting.

*Vitamins A and D.*—Periodontal disease was produced in dogs on a diet lacking in vitamins A and D by Mellanby (1930). With vitamin-A deficiency alone, the epithelium became thickened and inflamed, whereas when vitamin D was deficient the alveolar bone became defective and deep pockets occurred. Animals that had an abundance of both these vitamins during the growing period were better able to withstand deficiencies of the same vitamins in adult life.

Boyle (1938) found changes in the epithelium of rats on diets deficient in vitamin A, but added, "In our laboratory, rats and guinea-pigs maintained on diets deficient in vitamin A show little or no increased incidence of gingival infection or of rarefaction of alveolar bone over that of the starved control animals receiving adequate vitamin A". Most subsequent reports have shown that a vitamin-A deficiency caused epithelial changes, resulting in hyperplasia and keratosis and a lowered resistance to infection in the gingiva, rather than primary degenerative changes in the periodontal membrane and alveolar bone.

Confirmation of some of Mellanby's findings was reported by Becks and Weber (1931) in dogs on a low vitamin-D diet. These animals showed progressive bone atrophy and osteoporosis in the alveolar bone and surrounding trabeculæ, as well as in the general osseous system.

*Vitamin-B Complex.*—Becks and Morgan (1942) described the effects of a deficiency of the "filtrate fraction" (pantothenic acid, plus one or more unknowns) on the oral structures of dogs. In their summary, they stated that the "filtrate fraction deficiencies alone lead to severe malformation and resorption of roots, as well as resorption of parodontal bone structure, resulting in varying degrees of osteoporosis".

*Minerals.*—Simonton and Jones (1928) experimented on 138 puppies with varying diets to determine their effect on the bones and especially on the alveolar process. They found that diets which were potentially basic in reaction, and low in calcium, protein, and vitamin, in all cases produced changes in the alveolar bone of healthy, robust, adult dogs, similar to Gottlieb's diffuse atrophy. Another of their conclusions was that the alveolar process appeared to be more susceptible to slight dietary faults than did the long bones, and in young puppies responded more slowly to therapeutic measures.

*Inanition.*—From the foregoing, it would seem that almost any deficiency state in certain animals may lead to a condition in the periodontium resembling periodontosis. Glickman (Glickman, Morse, and Robinson, 1944; Glickman, 1949) reported that rats on total starvation for seven to thirty days, water only being permitted, showed alveolar bone loss in the absence of gingival inflammation. He suggested that a somewhat nebulous "bone factor" regulated the progress and severity of the bone loss. However, it is doubtful if any of the animal experiments have produced all the histopathological changes in the periodontal tissues found in human periodontosis. Thus, from the results of these animal experiments, we can say that no one specific nutritional deficiency appears to be associated with the production of periodontosis, but almost any severe deficiency state may produce some of the changes found in periodontosis in certain animals.

**Endocrine Imbalance.—**

*Hyperthyroidism.*—Goldman (1942) fed guinea-pigs measured amounts of thyroid extract for periods of one week to four months. Changes in the periodontal tissues similar to periodontosis were observed.

*Hyperparathyroidism.*—Jaffee, Bodansky, and Blair (1931) showed that the daily injection of parathyroid extract into guinea-pigs caused pathological changes in the periodontal tissues. These included generalized bone resorption, producing enlargement of the canals containing blood-vessels, formation of fibrous masses in the spongiosa, and resorption of the bone trabeculæ, evidenced by the presence of numerous osteoclasts. These findings were confirmed by Schour, Tweedy, and McJenkin (1934) in the rat.

*Hypopituitarism.*—Schour (1934) showed that the effect of hypophysectomy on rats was an inhibition of growth in young animals and progressive loss of weight in adults. The periodontal membrane showed many globules of cementum and a proliferation of epithelial remnants. The bone-marrow was fibrous, but the marrow spaces tended to decrease in size.

*Diabetes* (*Hypo-insulinism*). — Glickman (1946) studied the jaws of rats with diabetes artificially induced by injections of alloxan. The injection of this drug had a specific action upon the pancreatic islets of Langerhans, the beta cells either disappearing or being greatly reduced in numbers in the animals developing the disease. Of the 103 animals injected, 25 did not show an increased blood-sugar, or exhibit any other signs of diabetes. From the remainder which responded to the injections, only 33 survived the first few days, and these continued in a chronic diabetic condition. The controls were 18 animals which were not injected and the 25 animals which did not respond to the injections.

In 39 per cent of the chronic diabetic animals the alveolar bone showed changes. In varying degrees of severity the animals presented a reduction on the distribution and amount of bone formation, "an increase in bone resorption and a loss of bone substance arising from peripheral fragmentation and dissolution of bone matrix and its replacement by connective tissue". He also noted that when the alveolar bone changes were marked, comparable alterations were observed in other bones of the skeletal system.

The animals which died in the acute stage showed no bone changes, nor were any gingival changes found following the injections in any group.

*Adrenocortical Hormones.*—Recent work by Selye (1946), Albright (1947), and others has demonstrated that two groups of adrenocortical hormones affect the production of bone matrix. The glucocorticoids, such as corticosterone and cortisone, inhibit this activity, while the mineralocorticoids, such as desoxycortisone, have a stimulating effect. The sex hormones œstrin and testosterone also appear to have a stimulating action upon bone matrix formation.

Production of adrenocortical hormones is controlled by the anterior pituitary gland through the action of adrenocorticotrophic hormone (ACTH). Over-production of ACTH can result in osteoporosis, presumably through too little stimulation, or too much inhibition, of the osteoblasts by the adrenocortical hormones.

The stage of resistance of the "adaptation syndrome" of Selye is characterized by an

over-production of glucocorticoids, which could account for the tissue changes seen in periodontosis. Much experimental work still remains to be done as these hormones become more readily available. Results of experimental studies on the periodontal tissues have not yet been published.

## AETIOLOGY IN MAN

**Disturbance in Cementoblastic Activity.**—All cellular elements in the body have a certain life span and most of them must be continuously replaced, especially if they are under heavy functional influences. This applies particularly to the periodontal membrane in which the newly formed fibres have to be attached to the cementum on one side and to the alveolar bone on the other. These fibres can only be attached by being embedded into the newly formed matrix of these tissues. Should the vitality of the cementoblasts or osteoblasts in the periodontal membrane be so reduced that the formation of fresh cementoid or osteoid ceases then the degenerated periodontal fibres cannot be replaced, and gradually the first stage of periodontosis will develop. This concept of the importance of the continued deposition of cementum was first advanced by Gottlieb (1923).

With the loss of functional stimuli from the periodontal fibres, the alveolar bone will commence to resorb, producing a widening of the periodontal membrane. Occasionally, when the outer layer of the cementoid has become calcified, resorption of the cementum may be observed.

According to Gottlieb the downgrowth of the epithelial attachment in the second stage is a biological response of the epithelium to a change in the vitality of the cemental surface. This downgrowth is possible only when the periodontal fibres have lost their attachment to the cementum and can continue until newly formed cementum with fibres attached is found.

The separation of the epithelium from the root in the third stage was considered by Gottlieb to be the biological reaction of the epithelium to the tooth surface, independent of external influences.

**Constitutional *v.* Local Factors.**—Arkövy (1894) classified investigators into "localists", "constitutionalists", and "fusionists", and this concept of Gottlieb's, just described, would place him firmly in the constitutionalist group. Yet many consider that local factors are of primary importance in the aetiology of all types of periodontal disease. Thus Fish (1946) does not include periodontosis in his classification of periodontal disease. His "pyorrhea profounda", which shows a similar clinical picture to the third stage of periodontosis, is stated to be the result of chronic gingival irritation in individuals with less tough connective tissue. This recognition of a systemic factor would probably place him in the "fusionist" camp. The fact that the pocket is generally confined to one side of the tooth, he suggests, is due to the organisms themselves being pushed into the periodontal tissues or being arrested in the lymphatic vessels of the periodontal membrane. Here they form localized abscesses below the floor of the gingival sulcus which burst into the sulcus and thus deepen the pocket "overnight".

Box might be considered to be in the "localist" camp. But his statement on pericementitis fibrosa (1940): "This lesion appears to localize itself most often in the periodontal tissues of teeth in traumatogenic function", would suggest that he, too, is really a fusionist. Gratzinger (1948), however, suggests that "dynamic irritation", a form of traumatic occlusion, is the aetiological faction in periodontosis, and many others of the traumatic occlusion school hold similar views. They could be termed the true "localists".

Orban (1949) states that three factors may be assumed:—

*a.* A disturbance of the normal growth changes relating to the continuous vertical eruption, and mesial drift, of the teeth. This may be the result of a systemic disorder.

*b.* An interference with the normal repair processes during sleep by such conditions as bruxism or bruxomania.

*c.* Since this combination of systemic and local factors does not always lead to a breakdown of the supporting tissues, a third factor

is assumed—the "inherited inferiority of the dental organ".

**Traumatic Occlusion.**—Gottlieb and Orban (1931), in experiments on dogs, showed that trauma produces compression of the connective tissue, bleeding, necrosis, and bone resorption on the side of pressure, with new formation of bone on the side of tension. Later Orban (1936) showed that cusp interference causing "jiggling" of the tooth produced these typical pathological changes due to pressure on both sides of the tooth. This resulted in widening of the periodontal membrane, but the other pathological changes of periodontosis were not found.

The fact that periodontosis often occurs in complete dentitions with perfect occlusion, shows no preference for the pressure or tension side of the tooth, and may be found around teeth with no occlusion, would also suggest that traumatic occlusion is not a primary causative agent. Yet functional influence must be considered as a predisposing factor in the localization of the lesion. In this connexion, Orban and Weinmann (1942) state: "The preference of the disease for a certain localization may be due to a functional insufficiency of the suspensory apparatus. This functional insufficiency can be attributed to toxic influences which impair the physiological regenerative process in the connective tissue of the supporting structure, exposed to constant mechanical influences". When the disease is advanced and much supporting structure has been lost, normal function in mastication may produce traumatic changes, and thus hasten the destructive process.

**Gingival Inflammation.**—The case described by Gottlieb (1923) showed the disturbance at the apex of the teeth, whereas the marginal tissues were normal. This would seem to prove that inflammation is not a primary factor in the development of the disease. However, inflammation is always a complication in the later stages.

**Intrinsic Factors.**—Thus, intrinsic factors would appear to be of primary importance in the aetiology of the disease. But these factors may be of many types. Endocrine dysfunction, toxins from different sources, metabolic disturbances and dietary deficiencies, all appear to be capable of producing the disease.

Becks (1941) reported the frequency of systemic disturbances in 80 cases of periodontosis. He found that 54 per cent had hypothyroidism, half of these having other endocrine disturbances as well.

Endocrine disturbances without hypothyroidism were found in 30 per cent, while 12·5 per cent had systemic disturbances other than endocrine imbalance. These included intestinal disturbances, blood dyscrasias, allergies, and mineral and vitamin deficiencies. In 4 per cent no disturbance could be identified.

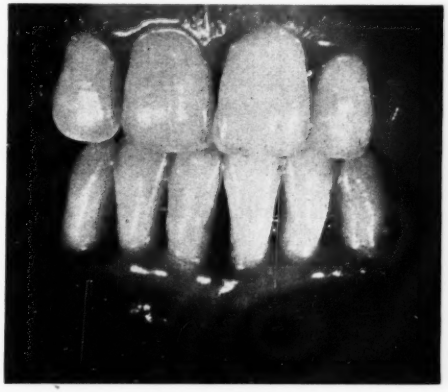

*Fig.* 6.—Case shown in *Figs.* 1 and 2 after gingivectomy in the lower jaw. These teeth were fairly firm and did not require splinting.

Weinmann (1927) found 21 out of 23 cases of diffuse atrophy to have a uniform deviation in metabolism. They showed a normal or slightly increased basal metabolism, and a reduced specific dynamic protein effect. This he suggested might be due to a hypofunction of the anterior pituitary or a disturbance of the vegetative nervous system. Most other investigators have not been able to discover systemic disturbances in such a high proportion of periodontosis cases, however.

### SUMMARY OF AETIOLOGICAL FACTORS

The aetiological factors in periodontosis might be summarized under three main

headings, with a subheading of a contributing factor:—

1. *Hereditary Factors.*—These might include general "toughness" of the connective tissues, some endocrine deficiencies, etc.

2. *Nutritional Deficiencies.*—These might include vitamins C, B, and D, minerals, proteins, or general under-nourishment.

in the absence of any of the other factors, could produce the disease.

## TREATMENT

Treatment of the condition should be directed towards the elimination of the periodontosis and the secondary periodontitis, which is invariably present by the time the case is diagnosed. It is generally considered that when more than two-thirds of the bony support of a tooth is lost, conservative treatment is hopeless and the tooth should be extracted. Although such treatment will undoubtedly cure the periodontitis, it can have no effect upon the underlying condition causing the periodontosis, if that condition is still operative. Fortunately, in many cases the primary cause of the disease seems to have disappeared by the time the patient presents for treatment. The prognosis of these cases is, of course, much better.

*Fig.* 7.—Palatal view of the upper incisors of the same case after a fixed splint had been cemented in place. This consisted of pin-lay preparation soldered together, and was made by Mr. W. A. Vale some weeks after an upper gingivectomy had been completed.

3. *Systemic Disease.*—Diseases of adaptation, diabetes, or any severe debilitating disease, resulting in a negative nitrogen balance for a prolonged period, e.g., tuberculosis, malignancies, etc., may be important factors.

No systemic disease invariably produces periodontosis, however. Yet any of these three factors, alone or in combination, may be responsible for the condition.

The contributing factor, which may determine which teeth are affected first, could be called:—

4. *Functional Stress.*—This stress need not be excessive, and the occlusion may appear to be ideal, yet the teeth incurring the greatest stress in relation to their root area may be the first to show clinical signs of periodontosis. Conditions such as bruxism may be important factors, by interfering with the normal repair processes in the periodontal tissues. But from the histological evidence it would not appear that any form of traumatic occlusion alone,

Whether radical or conservative treatment of the dental structures is decided upon, an attempt should be made to discover if any systemic condition, which may have been responsible for the disease, is still operative. Thus, a thorough medical examination should be advised and all known laboratory tests may be utilized. The diet should be investigated, and any possible deficiency rectified. Even with apparently satisfactory diets,

a course of polyvitamin therapy should be instituted. These measures, combined with any treatment advised as a result of the medical examination, may or may not affect the progress of the degenerative disease.

Treatment of the periodontitis should include the reduction of occlusal trauma by balancing the occlusion, removal of all tartar and thorough cleansing and polishing of the teeth, elimination of the pockets (*Fig.* 6), and the institution of a strict régime of oral hygiene. Teeth which have migrated may be moved back by orthodontic measures, but this may cause further loss of supporting structures. Splinting of the teeth, by fixed or removable appliances, may be resorted to where the teeth still tend to migrate, or when much alveolar bone is lost. (*Figs.* 7, 8.)

The exciting possibility remains that early cases of periodontosis may respond to systemic treatment with adrenocortical hormones. It is hoped that when greater supplies of these hormones become available some may be earmarked for research into this baffling periodontal condition.

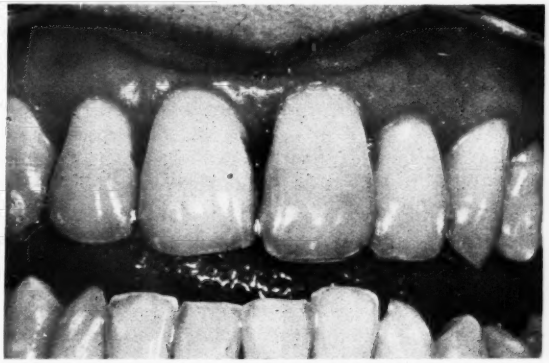

*Fig.* 8.—Anterior view of the upper incisors with the splint in place. Although $\underline{1}$ was extremely loose the bite is now comfortable and functional, and the patient is maintaining excellent oral hygiene with the toothbrush and soft wood points.

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# A REVIEW OF CURRENT ACRYLIC FILLING MATERIALS AND TECHNIQUES

By **J. W. McLEAN**, L.D.S. R.C.S. Eng.

*Demonstrator in Conservative Dentistry, Guy's Hospital Dental School*

THE following direct acrylic filling materials have been investigated:—

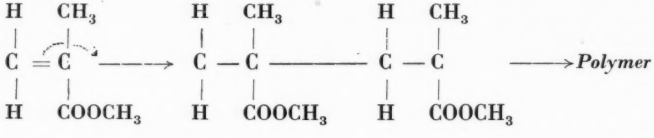
*a.* Portex 'Quick-set' Filcryl (Portland Plastics Ltd., Dover).
*b.* Plasto filling (Plastodent Inc., New York).
*c.* Hesacryl (Chemische Fabrik, Schönenwerd).
*d.* Acralite Fast Crown (Acralite Co., New York).
*e.* Replica (Cosmos Dental Products Co., New York).
*f.* Kadon (Caulk Co., Milford, U.S.A.).
*g.* Dentafil (Dental Fillings Ltd., London).

The fundamental difference between the denture base resins and the acrylic filling materials is the polymerization time factor.

| *Monomer* | | *Polymer* | | |
|---|---|---|---|---|
| 0·5–3 per cent *n*-trihexylamine (the trigger catalyst) | ⟶ | 0·5 per cent Benzoyl peroxide (oxygen liberating catalyst) | ⟶ | $O_2$ liberated, spontaneous polymerization occurs |

This accelerated polymerization is brought about by the use of catalysts in both monomer and polymer, and Schnebel, of Germany, developed the tertiary amine catalysts as the basis of his self-curing resins.

*Monomer*




The presence of free oxygen facilitates the opening of the unsaturated carbon valency of the acrylic radicle.

The denture base resins consist of the standard 80–120 mesh polymers (*Fig.* 1). If these globular polymers are submitted to monomer exposure for a period of ten to twenty minutes the granules are softened and a plastic 'dough' is formed. If, however, this process is cut short, as occurs with the self-polymerizing resins, the polymer granules are left comparatively intact and the acrylic mix will feel gritty (*Figs.* 2, 3). In order to overcome this defect the manufacturers of most of the new direct acrylic filling materials have introduced the ultra-fine polymers as a means of overcoming the mixing problems. These ultra-fine globules are similar in particle size to the oxyphosphate cements and are easily saturated by monomer within three minutes.

The microscopical examination of Kadon polymer will show the use of the ultra-fine polymers as the basis of the resin, and a larger flake-type polymer has been introduced to give body to the resin (*Fig.* 4).

These flake-type polymers will present the maximum surface area to the monomer.

Acrylic filling materials containing ultra-fine polymers:—

*Group A*
- Dentafil.
- Kadon.
- Portex 'Quick-set' Filcryl.

Acrylic filling materials containing only 120–500 mesh polymers:—

*Group B* { Hesacryl. / Plasto filling. / Replica. / Fast Crown.

Group A resins may be mixed on a glass slab or in a closed vessel.

Used in this way, a minimum of air is stirred into the material and also volatilization of the monomer is prevented. The Acralite Co. state that the powder and liquid should be stirred together once and not re-stirred before insertion.

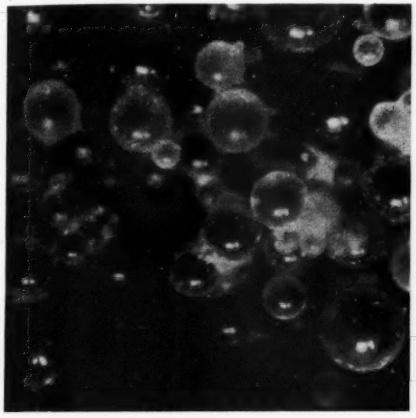


*Fig.* 1.—120-mesh polymer showing attachment of pigment granules to surface. (× 200.)

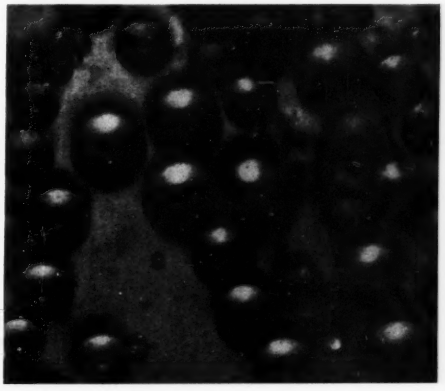


*Fig.* 2.—Spheroidal polymer prior to exposure to monomer. (× 100.)

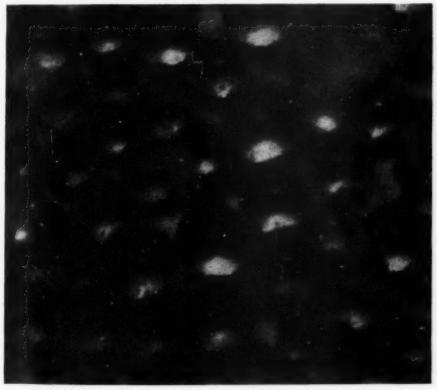


*Fig.* 3.—Spheroidal polymer exposed to monomer for five minutes. (× 100.)

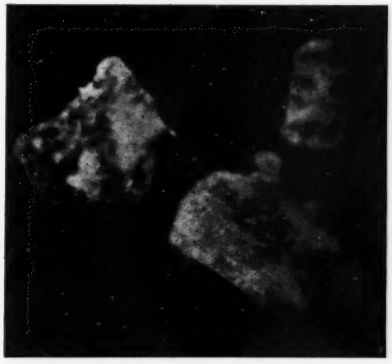


*Fig.* 4.—Kadon flake-type polymer. (× 200.)

Group B resins should be mixed in a closed vessel in order to provide maximum exposure of the polymers to the plasticizing effect of the monomer.

The use of a covered jar also prevents the disturbance of the mix until it has gelled.

**Polymerization Time Factor.**—The rate of polymerization of an acrylic filling is dependent upon the catalysts used. The proportions of trigger catalyst and peroxide require delicate balancing, otherwise discoloration of the finished resin may occur.

The polymerization of the resin is accompanied by exothermic heat generation and figures issued by the American Bureau of Standards are:—

| *Resin* | *Rise in Temperature* | |
|---|---|---|
| Fast Crown | 56° C. (133° F.) | 200 cu. mm. specimens |
| Dentafil | 68° C. (155° F.) | |
| Kadon | 89° C. (192° F.) | |

The rate of polymerization of the various brands of acrylic resins is set out below:—

| *Resin* | *Polymerization Time Factor at* 37° C. |
|---|---|
| Dentafil | 5–8 minutes |
| Kadon | 5–6 minutes |
| Replica | 8–12 minutes |
| Hesacryl<br>Portex 'Quick-set' Filcryl | Heat shock or infra-red required |
| Plasto filling | 10–15 minutes |
| Fast Crown | 10–15 minutes |

The rate of polymerization does influence the texture of the resins and the more rapidly polymerizing resins are liable to discolour if not carefully processed under pressure.

per cent, taking an average Brinell hardness reading of 28–30 for the standard resins.

**Porosity.**—The main type of porosity that will trouble the operator on first using a self-curing resin is condensation porosity (*Fig.* 5). If insufficient monomer has been used in the mix or volatilization occurs, the polymer granules will not be bonded. Insufficient pressure also will cause the polymer granules to appear in sharp relief and the spaces between them will stain readily. A correct mix and the use of a pressure matrix will produce a resin illustrated in *Fig.* 6. These sections were viewed with a metallurgical microscope,

*Fig.* 5.—Condensation porosity. Gentian violet stain visible in the inter-lattice spaces. (× 200.)

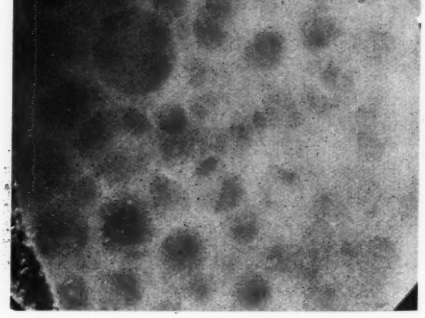


*Fig.* 6.—Dentafil correctly processed under pressure. (× 200.)

**Hardness.**—Tests have shown that all the self-polymerizing resins are softer than the high-temperature cured acrylics. This decrease in surface hardness ranges between 10 and 25

employing oblique illumination. *Fig.* 7 is a view of Dentafil after exposure to monomer for four minutes and prior to the use of a pressure matrix.

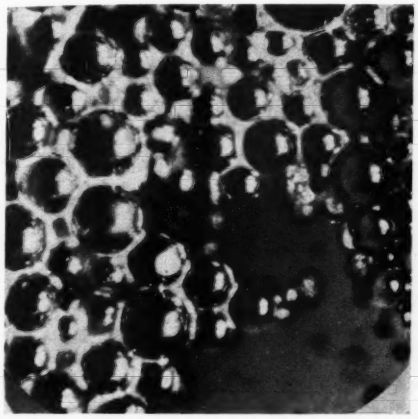


*Fig.* 7.—Dentafil exposed to monomer for four minutes and prior to the application of pressure. (× 200.)

**Heat Shock and Surface Staining.**—If the polymerization of the resin is accelerated by the application of excessive heat to the matrix band (80–120° C.), the surface veneer of acrylic will harden first and fix the material to the cavity edges. The filling will then tend to shrink away from the cavity base and subsequent leakage is liable to ensue (*Fig.* 8).

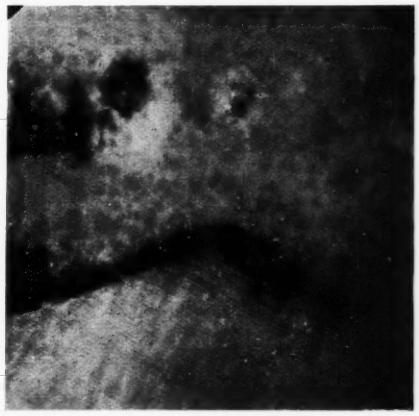


*Fig.* 8.—Heat shock treatment of an acrylic filling showing the volumetric shrinkage of the resin from the cavity base.

Acrylic fillings will not easily absorb surface stain, but the cavo surface angles will stain fairly quickly in some mouths (*Fig.* 9). In order to counteract this fault the cavity must be carefully inspected to avoid bevelling of the edges.

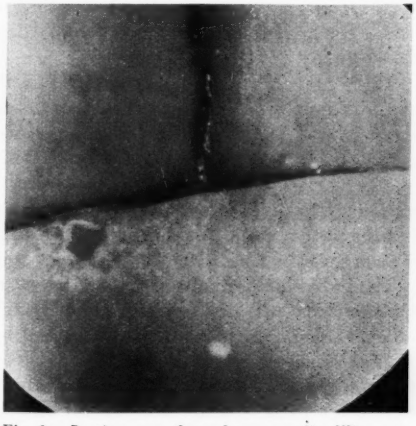


*Fig.* 9.—Section cut through an acrylic filling at the enamel surface. Note the crack in the enamel.

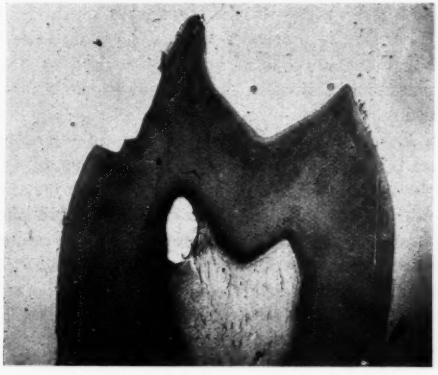


*Fig.* 10.—Filcryl resin inserted for three months. Œdema blister and pulpal hæmorrhages present.

**Histopathology.**—All self-curing acrylics will affect the pulp. *Fig.* 10 is a section of a premolar filled with Portex Filcryl for three

months. Briefly, the changes observed in the pulp are:—

1. Vacuolization of the odontoblasts.
2. Capillary invasion of the sub-odontoblast zone and pulpal hæmorrhages.
3. Serum exudate with œdema blister formation in the pulpal cornua (*see Fig.* 10).
4. Fibrotic degeneration.

The patients seldom experience pain and the teeth are not sensitive to thermal tests. The pulp shows no signs of calcific repair and death ensues frequently within six months.

Acrylic chloroform varnishes will not protect the pulp and the only safe method of insulation is a cement lining. Zinc oxide and eugenol should not be used owing to the plasticizing effect of the eugenol on the acrylic filling.

Owing to the lethal effect of acrylic monomer on the dental pulp, the author does not advise the use of the self-polymerizing resins for the fabrication of jacket crowns directly in the mouth or for the cementation of acrylic inlays without an oxyphosphate cement lining.

## CLINICAL TECHNIQUE

The self-polymerizing resins are most suitably used in Class III, IV, and V cavities.

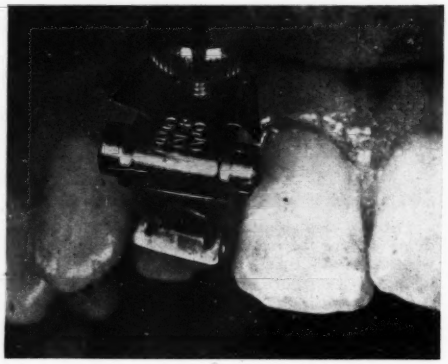
**The Class III Cavity.**—The cavity should be well undercut, especially towards the incisal and the gingival margins. Acrylic resin is not adhesive and depends upon mechanical locks for its retention form.

Numerous matrices are suitable for this type of cavity, but the individually made matrix has proved superior for the restoration involving the contact point. Any pre-formed matrix band that is tightened around the tooth will compress the resin and flatten the contact point.

*Pre-formed Matrices.*—

*a.* Muller matrix (*Fig.* 11).

*b.* Hawe matrix (alligator clip type).



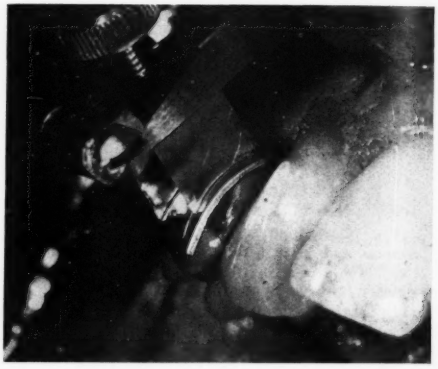


*Fig.* 11.—Muller matrix.

*c.* Bonnalie matrix.

*d.* Lennox matrix.

*e.* Tofflemire form-fitting matrix (W. Getz. Co., Illinois).

These matrices should be tightened on the tooth when the resin has reached the rubbery stage in the cavity and if necessary wooden gingival wedges may be employed. Any excess acrylic at the gingival interstices is extremely difficult to remove and the operator is advised to remove the filling and start again if such an eventuality occurs.

The individually made composition pressure matrix is illustrated in the photographs (*Figs.* 12–18).

*Fig.* 12 shows a view of the silicate fillings to be replaced in 1|12. The cavities are cut and lined with cement and the rubber dam applied (*Fig.* 13). A thin stainless steel strip or aluminium strip is adapted to the cavity margins and the palatal surface is held in position with a small piece of composition. If necessary, the gingival area is wedged.

*Fig.* 14 shows the strip in position; the composition (not visible in the photograph) is held by the index finger. The strip is now burnished carefully to the labial cavity edges and then peeled back again.

*Fig.* 12.—Silicate fillings to be replaced in $\frac{1|1\,2}{}$

*Fig.* 15 shows the pressure matrix which is used. The two trays are now filled with composition. The cavity is filled with a plastic paste mix of the resin which is allowed to dough. When the filling has reached the rubbery stage the strip is burnished lightly over the filling and towards the contact point. The pressure matrix is now screwed over the strip so that the palatal surface will adhere to the composition already in place and the labial surface is well covered. The composition is allowed to harden and the matrix is then screwed tightly into position (*Fig.* 16).

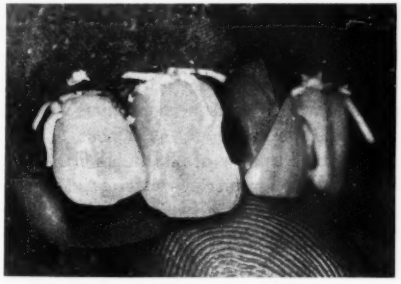


*Fig.* 14.—Steel strip held in position with composition backing retained by finger.

In this way a well-contoured contact point is assured.

**The Class IV Cavity.**—A standard 'Black' type cavity is prepared with very adequate retention locks at the gingival and incisal cavity angles. A cellulose acetate crown form (Cottrell & Co.) is fitted to the corner and wedged at the gingival margin; an escape channel is provided in order to prevent air-locks (*Fig.* 17).

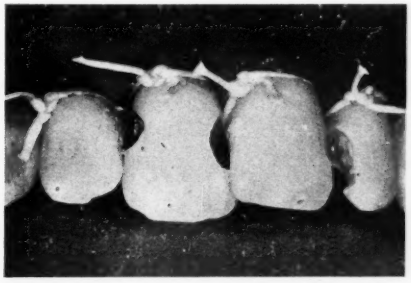


*Fig.* 13.—Cavities prepared for filling under rubber dam.

The crown form is filled with acrylic and the cavity undercuts packed carefully with the resin. The crown form is pressed over the tooth and excess acrylic resin is cleared from the edges. The pressure matrix, with its trays of softened composition, is then adapted over the restoration and pressure applied for the requisite time.

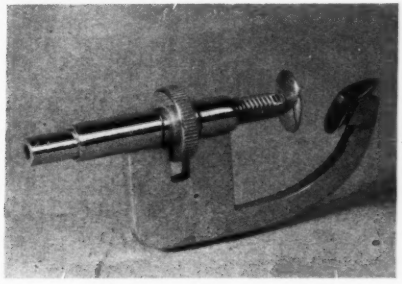


*Fig.* 15.—Pressure matrix.

When the acrylic is hard, the cellulose acetate former may be peeled off.

**The Class V Cavity.**—It is essential that this type of cavity is undercut with wheel burs in order to obtain maximum retention form.

Prior to cutting the cavity the pressure matrix is used to obtain an accurate impression of the cavity area. Tin-foil is first burnished to the labial surface of the tooth and then the matrix trays are warmed with their composition and screwed into position on the

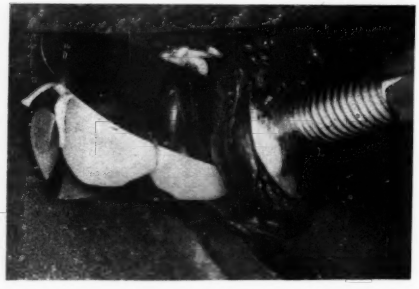


*Fig.* 16.—Pressure matrix with composition screwed into position.

tooth. The tin-foil will adhere to the composition and the matrix is removed and chilled, ready for use. The foil acts as a separating

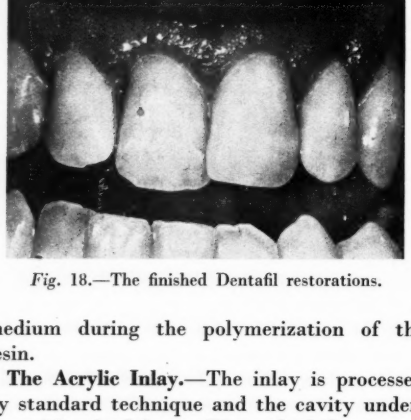


*Fig.* 18.—The finished Dentafil restorations.

medium during the polymerization of the resin.

**The Acrylic Inlay.**—The inlay is processed by standard technique and the cavity undercut with wheel burs. The pulpal floor must be lined. The self-curing acrylic should contain a high percentage of ultra-fine polymers if it is to be used as a cementing medium, since the seating of the inlay is dependent upon a fine polymer particle size.

The mix should be thin, since the inlay will absorb some monomer, and the inlay must be well coated with resin prior to insertion. The edges may be sealed over by applying a thin steel matrix band, backed by composition.

**Finishing of the Self-curing Acrylics.**—The matrix is retained in position for the maximum

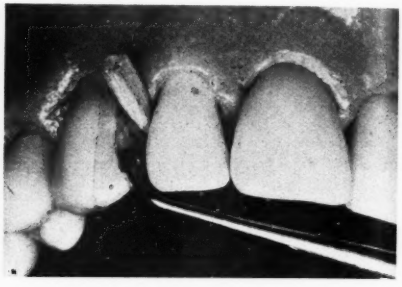


*Fig.* 17.—Cellulose acetate crown form wedged in position. The wire foil indicates the position of the escape channel.

time recommended to ensure finite polymerization, and on removal of the band the filling should present a high gloss finish.

The edges may be trimmed with diamond files, Rhein files, finishing burs, or sharp knives. A linen strip may be used to complete the trimming.

Polishing is best done with rubber cups and a paste of glycerin and pumice, then zinc oxide and water.

*Fig.* 18 is a view of the finished result. $\underline{1}|$ distal—Muller matrix. $\underline{1}|$ mesial—pressure matrix. $|\underline{1}$ distal—pressure matrix. $|\underline{2}$ mesial—cellulose acetate crown form.

I am indebted to the Metallurgical Department of the Royal School of Mines for the use of their apparatus in the preparation and photography of the acrylic filling sections and polymer.

My thanks are also due to the Dental Photographic Department, Guy's Hospital, for the clinical pictures.

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# THE OUTLINE OF THE FULL DENTURE

By **R. J. WHEATLEY**, L.D.S. R.C.S. Eng.

So many dentures, in some ways good ones, are failures because insufficient trouble has been taken in determining their outline, that a few words on the subject may not perhaps be out of place.

I believe it is not unusual for the outline of dentures to be left to the technician. That would be quite a safe thing to do—as far as the buccal, labial, and lingual limits are concerned—but only if thoroughly muscle-trimmed impressions have been taken. However, anybody who has not actually seen the patient cannot possibly accurately outline the posterior border of the upper denture by looking at the model alone.

It is surprising what little attention is given to the influence of certain muscle attachments on the outline of the buccal and labial flanges of dentures. I remember a patient attending at a hospital for dental treatment. He brought with him a letter from his doctor stating that there had been a great deal of difficulty with the dentures which were unstable because the muscles pulled them off the ridges, and that the dentist had suggested that the muscles be cut (*sic*) to allow the dentures to stay in place, and could this please be done? The patient looked very unhappy; one reason being that he couldn't even smile without dislodging his upper denture. A considerable improvement was immediately made by reducing the depth of flanges by about one-eighth of an inch, and the patient left with the first broad smile he had safely achieved for some months.

I only mention this to point out that if a reasonable amount of care had been taken to define the outline of the denture in the first place, there would have been no further trouble.

What we have to decide is how to determine the peripheral limit of the denture. The buccal and labial flanges should present no difficulty because they must be limited by the muscle attachment, and the reflection of the mucous membrane marking the depth of the sulcus.

The lingual flange of the lower denture presents a rather more difficult problem, and one that may be described as controversial. Some prosthetists carry the flange distally below the mylohyoid ridge. Some prefer to finish the denture just above it. I favour the latter procedure in most cases, although there are times when the denture flange may be carried below this ridge in the few cases when protrusion of the tongue will not cause instability. This point can best be decided when the tray is being shaped before the lower impression is taken.

Let us then begin with the lower denture.

For the best result I think that a special tray should be used, made on a model which has been cast from a first impression, which should be as nearly accurate as possible. Composition or plaster-of-Paris may be used for the first impression, and I prefer the latter. The special tray is made in metal or " acrylic " as a baseplate carrying a small handle placed over the labial part of the ridge, and the tray should occupy more space all over than is intended for the finished denture.

I usually use an acrylic tray in preference to metal because it is more easily shaped. Before taking the impression the tray is tried in the mouth and lightly held in place. If now the cheeks and lip are gently pulled upwards, because the tray is slightly overextended, it will be lifted by pressure at the sulcus. The buccal and labial flanges should be reduced by stoning down until the tray is not displaced by any movement of the lip or cheeks. The lingual side is now prepared. The patient is asked to lift the tongue and again the tray will rise. When the tongue is raised, the tray should be pressed down and wherever the lingual flange is too deep a movement of the mucous membrane will be observed. The tray should be reduced in depth at these places until no movement of the tongue will dislodge it. At the "heels" the tray is extended as far as possible over the retromolar pad, but no discomfort must be felt. We have now a rough

outline of a denture which will be limited by the buccal, labial, and lingual sulci, and should not be dislodged when the labial and lingual muscles are brought into play. I say a rough outline, because the shaping of the tray with a stone will not have been quite accurate. At this stage I reduce the width of the tray on the buccal and lingual sides by about $\frac{1}{32}$ in., after which the impression may be taken.

A stick of composition is softened in a flame and drawn along the margins of the tray for about an inch and a half. The tray has been reduced by $\frac{1}{32}$ in., as described above, to accommodate this composition. The same movements of the cheeks, lip, and tongue as were used in shaping the tray are now used again while the composition in a soft state is traced in short lengths at a time along the margins of the tray, until the whole periphery is completely "muscle trimmed" (*Fig.* 1). To complete the impression I use a proprietory impression paste, and after the tray is inserted I tell the patient to move the tongue upwards and then forwards while I pull gently on the lip and cheeks as before described. During this procedure the tray is held firmly in position.

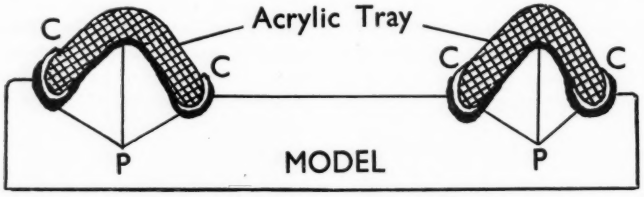



*Fig.* 1.—End-on view of lower model with tray in place. C, Muscle-trimmed composition; P, Impression paste covering composition.

If the ridge is reasonably good it will often be found that a considerable amount of suction is obtained, and I have known many cases where some difficulty has been experienced in removing such an impression until the peripheral seal has been broken by pulling out the cheek.

For the upper denture outline a similar technique will do very well, except, of course, that there is the additional difficulty of determining the limit of the palatal edge, and this plays a very important part in securing a well-fitting comfortable upper denture.

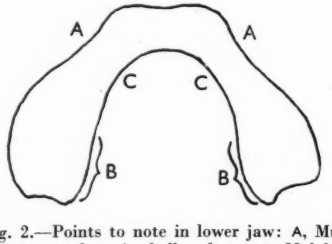



*Fig.* 2.—Points to note in lower jaw: A, Muscle attachments; base is shallow here. B, Mylohyoid ridge where pressure is always painful. C, Torus mandibularis; not always present; pressure here is painful.

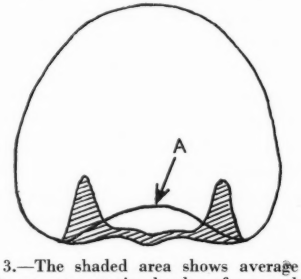


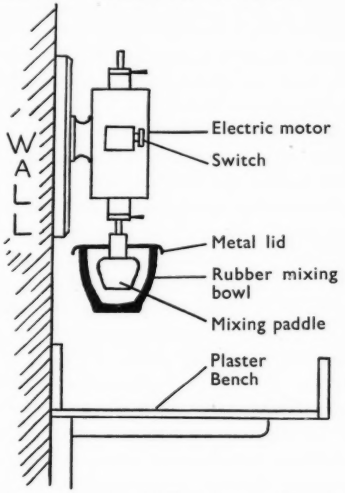

*Fig.* 3.—The shaded area shows average compressible area at posterior border of upper denture to form a post dam. The line A shows the posterior limit of many dentures, probably guessed at by the technician.

It is not uncommon to see the posterior line of an upper denture drawn by guesswork in some sort of curve between the tuberosities, in most cases much too far forward. The posterior limit of the upper denture should be on the compressible soft tissue immediately behind the hard palate, but should not extend to the moving part of the soft palate. This line may be determined by feeling with a round-headed plastic instrument along the line of demarcation between the hard palate and the soft palate. In most cases it will follow the line shown in *Fig.* 3.

# ILLUSTRATED HINTS

## A MECHANICAL PLASTER MIXER

Many dental practitioners will probably possess a dental lathe or other variable-speed motor which, though still in working order, has outlived its usefulness on the bench.



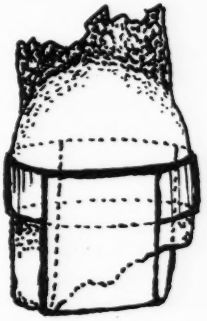

Such a motor, vertically mounted over the plaster-bench, can readily be converted for use as a mechanical mixer. A mixing paddle constructed of $\frac{1}{8}$-in. brass plate is attached to an ordinary lathe chuck by brazing. To prevent the plaster from being displaced from the rubber mixing bowl during rotation of the mixer a metal lid is required. An aluminium pan lid with a hole drilled in the centre is very suitable.

By means of this apparatus a particularly smooth mix is obtained, especially for the artificial stone type of material, and in consequence of the reduction in mixing time a longer working period is available.

D. R. Carrington.

## PROTECTION FOR FRACTURED INCISOR

It is sometimes difficult to protect a fractured incisor from thermal changes during the period of pulp retraction as no real hold can be provided for the cement. The simple shovel crown illustrated is very useful and



it can be left in position for long periods. If a welder is available the crown can be very quickly made, using 3 mm. $\times$ 0·1 mm. material for the band and 5 or 6 mm. $\times$ 0·1 mm. for the covering strap. If no welder is available the crown can be made of precious metal or nickel silver and soldered.

B. R. Townend.

## THE BRITISH SOCIETY OF PERIODONTOLOGY

The next meeting of the Society is to be held at the Dental Hospital of Manchester, on Monday, Feb. 12, 1951, at **3 p.m.**, and not at 3.30 p.m. as indicated in the programme.

A paper will be read by Mr. A. F. Stammers, M.D.S., entitled "Local Causes of Periodontal Disease", and a casual communication will be given by Mr. J. Harrington, B.D.S.

Through the courtesy of the Director, members will have the opportunity of visiting the School during the afternoon.

**Clinical Meeting:** The Clinical Meeting is to take place on Monday, April 9, 1951, during the afternoon, at the Institute of Dental Surgery, Eastman Dental Hospital, Gray's Inn Road, London, W.C.1. A Committee has been formed to make the arrangements for this meeting, and the names of those who are prepared to give demonstrations should be forwarded as soon as possible to the Secretary, Mr. W. G. Cross, at the Institute of Dental Surgery.

# LETTERS TO THE EDITOR

Sir,

In an article in the January issue (p. 154) Mr. C. H. I. Millar advocates the training of 6000 dental nurses in order to provide adequate dental treatment for schoolchildren; adding: "The expense . . . would be very great indeed". It is therefore logical to inquire whether this money could be better spent.

Allowing for a wastage of 10 per cent, an output of 600 nurses per year would be required to maintain a total number of 6000. The dental student's course is two and a half times the length of that of the dental nurse's, and, allowing for the larger amount of equipment and increased staff required, it is probable that the proposed expenditure would allow for the training of 240 dental students per year. Assuming the working life of a dentist to be twenty-five years, this represents an additional 6000 dentists. This apparent paradox can be resolved if it is realized that either scheme would mean that 1200 students would be in training at any one time, and a little consideration will show that the cost of their training will not be greatly different whether they are dental students or nurses. The important point is that the ratio of working life to cost of training is the same for dentists and dental nurses, but there is a longer period before the dentists are up to full strength.

The choice is clear—rapid dilution or slow but sure improvement (or neither if the Health Service expenditure continues to be cut).

Yours etc.,

2, *Conduit Road,* C. P. WALLIS.
*Bedford.*

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Dear Sir,

I am pleased to have Mr. Soul's comments, more especially because I think mental exercise of this kind is a sign of good health in the profession. I have always been a keen student of Fish, but his conclusion that "once organisms have invaded the pulp tissue there can be no hope of the latter retaining its vitality" is becoming increasingly difficult to accept in the light of my own experience. Of fourteen selected pulp conservation cases completed since 1948 all have been successful, and in all cases the patients had complained of spontaneous aches, not just irritability due to the action of sweet or cold or hot changes.

In these cases the pulp must have been invaded, or if not invaded, must have been infected at the time the exposure was made. The pulp paste I now use contains an antibiotic, and in these cases either calcium penicillin or neutral calcium glyoxalate was used to control infection.

Before any pulp conservation operation can be successful a state of pathology must exist prior to, and is essential to, the preliminary calcification. Once a preliminary prosthetic barrier of calcification has been established within and around the degenerating tissue subsequent to exposure, it appears from my experience that the underlying healthy tissue is capable of laying down a layer of true secondary dentine or, as I prefer to call it, a layer of densification.

In the case under discussion what should normally have followed an acute hyperæmia of the pulp did not occur, as may be verified from the original X-ray, though nine years have elapsed.

*Yours faithfully,*

"*Caladh,*" CHARLES DILLON.
*Fort William,*
*Inverness-shire.*


## PREVIEW

No. 7 MARCH

Norwegian Plate Construction for Cl. II, Div. 1
*J. S. Beresford, B.D.S., H.D.D. R.C.S. Edin.*

A Cavity Preparation for Cl. II Fillings in Deciduous Molars
*Charles H. I. Millar, L.D.S. V.U. Manc.*

Dental Mechanics and Materials, No. 1
*John E. Seear, L.D.S. R.C.S.*

Dentists and the Law relating to Negligence
*R. L. Ward, Barrister-at-Law*

Illustrated Hints New Materials and Appliances

Parliamentary Notes Abstracts Book Reviews

COLOURED CHART No. 4

# MINISTRY OF HEALTH

## ORAL HYGIENISTS

*Statement on the Progress of the Experiment in the Training and Use of Oral Hygienists being undertaken by the Ministry of Health*

### Introduction

1. In May, 1949, the Standing Dental Advisory Committee accepted the Minister's invitation to co-operate in the observing of the experiment in the training and use of oral hygienists which was being initiated by the Minister in accordance with the recommendation of the Teviot Committee.

2. The Committee set up a Sub-committee which included members of other interested bodies,

> "... to observe the progress of the experimental scheme being carried out by the Minister of Health for training oral hygienists and to assess its results."

3. The membership of the Sub-committee is as follows:—

Mr. H. T. Roper-Hall (*Chairman* until May, 1950, when he resigned from the membership of the Standing Dental Advisory Committee and the Sub-committee); Mr. F. J. Ballard (*Chairman*); Mr. J. F. Pilbeam—nominated by the Standing Dental Advisory Committee.

Mr. C. V. Armitage—nominated by the Public Dental Service Association; Mr. R. Morgan—nominated by the Incorporated Dental Society—now constituent member Associations of the British Dental Association.

Mr. W. B. Grandison—nominated by the British Dental Association.

Mr. R. G. Heegaard Warner—nominated by the Dental Board of the United Kingdom.

Dr. R. Scott Dow—Chairman of the Scottish Standing Dental Advisory Committee; Dr. A. T. Wynne—Ministry of Education; The Principal Dental Officer of the Ministry of Health—constant attenders.

4. The Sub-committee has informed the Committee of the progress of the experiment and has submitted suggestions on various of its aspects.

5. The Sub-committee's views and its suggestions are contained in the following paragraphs. These views refer only to matters affecting the progress of the present experiment: the Sub-committee's recommendations must, of course, await the result of the experiment.

6. The Sub-committee, which has met three times since it was appointed in September, 1949, has seen students in training, and certificated hygienists at work: verbal and written reports on the training and work of certificated hygienists have been received.

7. The Sub-committee records its appreciation of the co-operation and assistance it received from Mr. A. C. Deverell, F.D.S., the former Director of the Eastman Dental Hospital.

### Ex-R.A.F. Hygienists

8. The Committee understands that there are twenty-three ex-R.A.F. hygienists who have been certified by the Minister as competent to undertake the duties of an oral hygienist. A trial of the use of twenty of these twenty-three hygienists is being made in Local Authority and Hospital Services; the remaining three withdrew after obtaining their certificates, one because she was leaving the country, and two owing to marriage.

### Training Courses

9. The first full course of training, comprising tuition for an academic year, was begun at the Eastman Dental Hospital in November, 1949, and a second in May, 1950. Fifteen students were enrolled in each course.

### Previous Education and Experience

10. The Sub-committee has received the reports of the Selection Committees who interviewed candidates for the first two courses of training and has observed that the results of the final examination for the first course of training suggest that the Selection Committees were justified in accepting, in exceptional cases, some candidates who had

not obtained a school certificate awarded by a University examining body and recognized by the Ministry of Education, or its equivalent.

11. It has been noted also that the majority of selected candidates have had experience as dental attendants in private practice, in hospital or local authority service.

### Age Limit

12. The Committee understands that of the candidates selected for the first two courses six were aged 30 years or over. The Sub-committee considers that until further evidence is available as to the abilities and skill of these older women selected for training, candidates over the age of 30 years should not be rejected on the ground of age alone.

### Health

13. The Sub-committee considers it important that the health of the student hygienist should be safeguarded and suggests that, in addition to a medical examination before being accepted for training, a student's health should be under supervision during the course.

### Standard of Training

14. The Sub-committee regards it as important that the high standard of training set in the first two courses should be maintained throughout the experiment.

### Staff

15. The Sub-committee notes that the training of hygienists has been brought under the immediate direction of a Senior Hospital Dental Officer, and pays tribute to the excellent tuition which has been given since the beginning of the courses by the Senior Instructor and her assistant.

### Examinations

16. The Committee notes that the examination now taken by oral hygienists is prescribed by the Minister of Health, and is conducted by an internal and an external examiner. Detailed records of hygienists who have been trained as part of the experiment, and have obtained a certificate of proficiency, are kept in the Department.

### Reports from Employing Authorities

17. The Sub-committee has received reports from authorities employing hygienists. These reports made it clear that the work of the hygienists is of assistance to dental officers, particularly in the hospital services, and that the work of hygienists is considered by them to be of a good standard. The Sub-committee has expressed no view in the light of these reports, which refer only to an average period of employment of ten months, on the ultimate value of oral hygienists.

### Future Courses

18. The Committee is informed that there has been a considerable number of applicants for the first two courses of training. In order, however, that there may continue to be a sufficient number of suitable applicants from which to select students for training, and that students should be drawn from all sources (which, the Committee feels, is particularly important since this scheme is experimental), the Sub-committee is of the view that consideration should be given to the need for wider publicity about the Scheme which will reach all potential trainees.

19. Although the Sub-committee is informed that provincial candidates are, apparently, not discouraged from applying for inclusion in a course because it is held in London, it has expressed the view that consideration should be given to the possibilities of providing, as part of the experiment, training courses in centres other than London. It appreciates, however, that there may be practical difficulties in organizing courses of this experimental nature in more than one centre.

20. The Committee is informed that there are, at present, thirty-four certificated hygienists whose clinical value is under observation, that there are fifteen students in training, and that a further fifteen are due to commence shortly. It is important that the number of hygienists trained within a reasonable time should be sufficient to enable the value of their work to be assessed.

21. The Sub-committee is continuing to keep the Committee informed of the progress of the experimental scheme.

# DENTAL BOARD OF THE UNITED KINGDOM

## SUMMARY OF REPORTS OF COMMITTEES, NOVEMBER, 1950

### Dental Health Education

Recommended that with the exception of the film, "Nature shows the Way" the other films produced by the Board before the war be no longer sponsored.

The Oral Hygiene Exhibition Committee of the XIth International Dental Congress have not been able to progress with the production of a film on the eruption and development of the teeth, because no financial support has been forthcoming from the Ministries of Health and Education. The £1000 granted by the Board for this purpose has not therefore been used.

In view of the shortage of good non-technical dental films the Central Office of Information were asked to consider the production of a film on the building of good teeth and the prevention of dental caries, designed primarily for prospective parents, health visitors, nursery matrons, nursery nurses, etc.

The Advisory Committee were requested to continue their inquiries into the production of a film or films to replace those which are recommended to be withdrawn from circulation. £3000 to cover the possible cost of producing such a film or films should this prove practicable, has been included in the estimated expenditure for 1951.

Material in course of production includes a new poster, a leaflet on tooth cleaning, and a booklet to replace "Hygiene of the Mouth and Teeth". The Finance Committee were requested to allocate £3500 to cover the cost of these items, to cover the cost of reprinting folders and booklets already published, and also to make possible the production of a new booklet for mothers. The total allocation requested for next year is, therefore, £6500.

### Educational Grants

1. The Queen's University, Belfast, has accepted a grant of £400 a year for the period of one year, commencing Oct. 1, 1950, in aid of the salary of a half-time Tutor and Lecturer in Clinical Dental Surgery.

2. *Educational Films.*—The Advisory Committee on Visual Education in Dentistry have accepted a grant of £1500 to enable them to obtain copies of a number of films which are considered of value for teaching purposes and which are not available for general distribution. The Advisory Committee, with the help of specialists, have already viewed and appraised sixty-one films, of which thirty-one are considered to be of "exceptional value for teaching purposes". These selected films have been grouped into three sections according to the order of priority in which they should be copied. As soon as the necessary permission of the owners has been obtained, it is proposed to ask the Chairman and Treasurers, in accordance with the Board's resolution, to sanction the immediate copying of thirteen of the selected films.

A number of the films are silent and, in the opinion of the Advisory Committee, insufficiently captioned. The possibility of adding commentaries by means of sound tracks has therefore been considered, but, in view of the expense involved, it has been decided that instead commentaries in typescript should be prepared, with the help of the owners, and circulated with the copies of the films.

The Advisory Committee are of opinion that the library service should be self-supporting and that a small fund should be built up which would be available to maintain the films in good order. They recommend that the following scale of hiring charges should be adopted and should commence on Jan. 1, 1951:—

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| For a reel of | 400 | feet or less | 10s. | post | free | | |
| ,, ,, ,, ,, | 800 | ,, ,, ,, | 20s. | ,, | ,, | | |
| ,, ,, ,, ,, | 1,600 | ,, ,, ,, | 40s. | ,, | ,, | | |

### Education and Research

1. *Grants for Research.*—Recommended that Mr. E. B. Brain be offered a further grant of £100 towards the costs of research in which he is now engaged in the School of Dentistry of the University of Birmingham.

2. *Dental Post-graduate Bureau.*—The Committee have had under consideration the question of ensuring the continuance of the work of the Dental Post-graduate Bureau in the immediate future. The functions of the Bureau have proved of great value both at home and overseas and the Committee accept the view that its work should continue. It is the opinion of the Committee that, if arrangements can be made by the Board for the financing of the Bureau during the next few years, transfer of this responsibility may in the interval pass to some other body. They accordingly recommend that provision be made for expenditure for a period of three years commencing Jan. 1, 1951, at a rate not exceeding £1500 a year.

### Finance

1. *Expenditure in* 1950.—Estimated that for the year 1950 the income will amount to £30,089 and expenditure to £29,200, leaving a surplus of £889.

This estimate of expenditure takes no account of the considerable liability which is accruing in connexion with the rehabilitation of the Board's premises. As it will not be possible to determine accurately at Dec. 31, 1950, the amount of this liability, the Committee propose to make provision in the accounts by appropriating from the unappropriated balance a sum, based on the latest information available at that date, at present estimated to be approximately £4500.

In November, 1949, the General Medical Council approved the allocations by the Board of sums not exceeding the amount specified under each head to the following purposes for expenditure in the year 1950:—

| | £ |
|---|---|
| Educational grants .. .. | 4500 |
| Dental health education .. | 4000 |
| Grants for research and for post-graduate dental education .. | 2500 |
| | £11,000 |

The Committee are informed that both the Educational Grants Committee and the Dental Health Education Committee have experienced unavoidable delays in carrying out the programmes on which these allocations were based. Expenditure in the year on educational grants is not expected to exceed £1500; expenditure on dental health education is not expected to exceed £1820, and expenditure on grants for research and post-graduate education is not expected to exceed £1700. The Committee have accordingly included only these amounts in their estimate.

2. *Expenditure in* 1951.—The Committee have received the following requisitions for the year 1951:—

*Educational Grants Committee*, £3500.
*Dental Health Education Committee*, £6500.
*Education and Research Committee*, £3300.

It is estimated that the receipts for the year 1951 will amount to £30,300 and the general expenses to £22,739. There should therefore be a balance of £7561 towards the special expenditure of £13,300 requisitioned by Committees.

If the amounts requisitioned by Committees are required in full, a deficit of £5739 for the year 1951 would result. In November, 1949, it was estimated that there would be a substantial deficit in 1950, but as certain items of expenditure which were included in that budget cannot now be incurred this year and have therefore been included in the budget for 1951, there should be a small surplus in 1950 instead of the anticipated deficit. In addition, certain other items of expenditure which are included in the budget for 1951 are of a non-recurrent nature. The Committee therefore recommend that the deficit for 1951, which is not expected to exceed the sum of £5739, be met out of the unappropriated balance.

## DENTISTS REGISTER

### Name of Dentist erased from the Register

The name of the following dental practitioner was erased from the Dentists Register as from Nov. 28, 1950:—

*Name and Status*: Vickers, Charles Dentith, Dentists Act, 1921.

*Last Registered Address*: 148, High Street, Hounslow, Middlesex.

# ABSTRACTS
## *from Other Journals*

### Chloromycetin—Streptomycin Therapy in Endodontics

The development of an effective antibiotic mixture for root-canal therapy has now reached a stage where, in the majority of cases, it is possible to obtain a negative culture after one treatment.

Previous reports dealing with the use of penicillin of low unitage were not too encouraging. When the concentration of penicillin was increased, the treatment was more effective. However, it was found that this antibiotic failed to sterilize many root canals infected with Gram-negative organisms. Subsequently, combinations of penicillin and streptomycin in peanut oil and in propyleneglycol were employed.

Reports showed that the combination of the two antibiotics was not only a highly effective bactericide, but also that a synergistic effect existed against certain bacteria. It was not possible to sterilize every root canal even with this combination. In comparing the anti-bacterial spectrum of chloramphenicol (chloromycetin) and streptomycin, it appeared that these two antibiotics together were capable of killing every type of organism encountered in an infected root canal, with the exception of fungi.—SELTZER, S., and BENDER, I. B. (1950), *Oral Surg., oral Med., oral Path.*, **3**, 1279.

### Hypnotic Suggestion in Dentistry

It has been found most satisfying to induce a state of reverie or sleep prior to injection of local anæsthetic and extraction. The effect of the drug can then be hastened by suggestion, and extraction performed almost immediately after injection.

Suggestions are then made to ensure that the patient feels well on waking up, and, if necessary, to decrease or eliminate the discomfort of the healing process. The following is a brief account of the procedure which is adopted to induce the hypnotic state, using a "pseudo-anæsthetic".

After a preliminary explanation of the benefits of relaxation, the patient is told that a cotton-wool roll soaked in chemical is about to be held close to his nose. He is told to let himself relax and not to resist; to breathe the chemical in and out quietly and he will pass into a very pleasantly dreamy state. That he will not succeed in doing so if he resists. "Breathe in and out quietly. Don't fight me; just let yourself go. You will not go to sleep. You will feel warm and dreamy and won't care about anything."

Suggestion is now directed toward the actual treatment in view. When the patient has been roused, the operator points out the former's complete disregard for the treatment. It is explained that his relaxation was the important factor in the process, and that the chemical inhaled was not a true anæsthetic, although it had helped him to sleep. The general aim is to educate the patient to appreciate how relaxation itself produces the effect.

At a later stage, mutual co-operation may be sufficiently increased to allow the patient to pass into the required hypnotic state by merely instructing him to do so. The instruction "relax" or "sleep" will then ensure a fully co-operative patient.—BARNETT, S. (1950), *Brit. dent. J.*, **88**, 96.

[*Editor's Note.*—Practitioners are reminded that if they employ hypnosis or any measures inducing sleep or unconsciousness they would be well advised previously to obtain the consent of the patient, parent, or guardian in writing and to do this work only in the presence of a witness, female in the case of female patients.]

"If therefore the profession which you have chosen has some unexpected inconveniences, console yourself by reflecting that no profession is without them."—SAMUEL JOHNSON, 1766.

# BOOK REVIEWS

**ORAL PATHOLOGY.** A Histological, Roentgenological, and Clinical Study of the Diseases of the Teeth, Jaws, and Mouth. By KURT H. THOMA, D.M.D., F.D.S. R.C.S., Professor of Oral Surgery, Emeritus, and Brackett Professor of Oral Pathology, Harvard University. Third edition. $6\frac{5}{8} \times 9\frac{3}{4}$ in. Pp. 1592 + xx, with 1660 illustrations, 78 in colour. 1950. London: Kimpton. £6 5s.

THIS text-book on oral pathology, in its extensively revised and rearranged third edition, containing 1660 illustrations of which 78 are in colour, must be considered a masterpiece of specialized dental literature. It covers the histological study of oral diseases, correlating the microscopical picture with the radiographic and clinical findings. It is divided into nine parts: experimental pathology; anomalies and diseases of the teeth; odontitis; anomalies and diseases of the head and jaws; abnormalities and diseases of the temporomandibular articulation; diseases of the nerves and muscles of the face and jaws; mouth diseases; diseases of the salivary and mucous glands; and tumours of the jaws. Each part is subdivided into chapters, which terminate with an exhaustive list of references. Thus not only does the book deal with dental structures, but also with subjects such as blood dyscrasias, food deficiencies, metabolic disturbances, skin diseases, etc., which have a bearing on oral tissues in general. This enables the reader, whether student, teacher, practitioner, or research worker in dentistry, to gain a wider vision of a subject in which he is naturally interested. The value of this book, however, would be greatly enhanced if in future editions some of the old photomicrographs could be replaced with photomicrographs taken with the latest technique. Kurt Thoma is world renowned as a great clinician, surgeon, and pathologist, and, like him, his book will go down in dental history. The author and publishers are to be congratulated on compiling and producing this book, which should be in the hands of every dental practitioner.

H. M.

**RADIOLOGY OF THE TEETH AND JAWS, including Dental Radiography.** For Students and Practitioners of Dental Surgery and Radiology. By FRANK L. INGRAM, D.M.R.D., L.D.S., M.R.C.S., L.R.C.P., Senior Assistant in the Diagnostic X-ray Department of Guy's Hospital; Lecturer in Dental Radiology at Guy's Hospital Dental School. $5\frac{3}{4} \times 9$ in. Pp. 160, with 281 illustrations. 1950. London: Edward Arnold & Co. 16s.

THIS book had an unfortunate setback when first issued, as the illustrations of the first impression, which was subsequently withdrawn, left a great deal to be desired, and some notices commenting adversely on this fact have been published. This fault has been completely rectified, the general standard of reproduction of the X-rays now being excellent. The success of a book of this nature is entirely dependent on the quality of the illustrations, and the publishers are to be congratulated on their action in withdrawing the faulty issue and replacing it entirely.

Mr. Ingram has provided a book which does indeed fulfil a long-felt need. He presents a concise and comprehensive series of radiographs illustrating all the normal and pathological appearances of the teeth, their supporting tissues and associated structures, with a fully descriptive text which is clear, and, unlike many comparable American text-books, easily understood. The term "gumboil", however, appears somewhat out of place in a book intended for use by the dental profession. The section on radiography is short and could with advantage have been expanded. This applies especially to the chapter on mechanical processes and the paragraph on bite-wing examinations. Nevertheless, these are minor detractions from the general excellence of the book, which will prove a valuable asset to the student and dental surgeon alike.

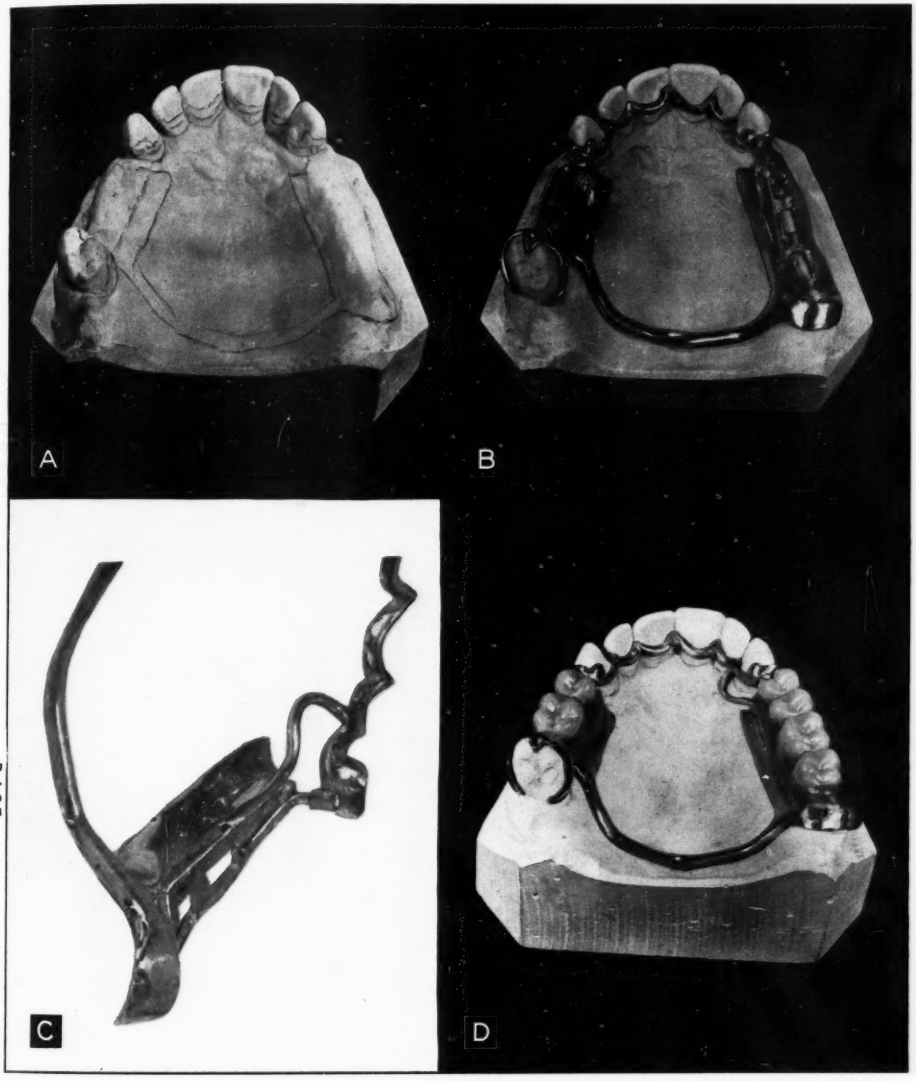
D. F. S.

"Knowledge is power."—BACON.

*Issued with "The Dental Practitioner," Feb., 1951, Vol. I, No. 6*

# PARTIAL DENTURE CONSTRUCTION PROBLEMS

## CHART No. 3




**A PARTIAL DENTURE WITH A STRESSBREAKER**

An attempt to deal with the problem of the "Free End Saddle".

The left side has no teeth standing distally to |3, while the opposite side has 7| standing. If the denture is supported by occlusal rests, it obviously becomes unbalanced, and during mastication great strain is put upon |3. This leads to periodontal trouble and eventual loss of the tooth. The method suggested here relieves that strain and has proved very successful in practice.

A, Shows model with design of skeleton; B, Framework, cast with platinized gold; C, Stressbreaker device incorporated (this photograph has been turned 90° for convenience); D, Finished denture.

The actual stressbreaker is a platinum alloy wire, which must have long fatigue life and wide range of heat treatment, adaptable to any balanced alloy used in the framework. In this case Baker Q.A. gauge I was used, soldered between the continuous clasp and the saddle in the position shown. It is most important that the correct solder is used—for plate golds usually 650. A lower carat would reduce the efficiency of the wire. Following this, some platinum alloy D section rod and tubing, similar to that used for orthodontic appliances, was positioned between the saddle and clasp. Whiting, for antiflux, was inserted in the tubing, and the rod pushed through. They were then soldered carefully in their relative positions—the tubing to the clasp and the rod to the saddle. With a fret-saw the original connecting bar between saddle and clasp was cut away, leaving the wire, rod, and tubing as attachments. This allowed for movement under stress of bite closure, the stressbreaker wire ensuring return to normal position, the rod and tubing allowing up-and-down movement and preventing drift of the saddle area.

C. T. YOULES.

# THE PROCEEDINGS OF THE BRITISH SOCIETY OF PERIODONTOLOGY

*President*: C. B. DE VERE GREEN, F.D.S.

*Hon. Secretary*: W. G. CROSS, M.S., B.D.S. Institute of Dental Surgery, Eastman Dental Hospital, Gray's Inn Road, London, W.C.1.

No. 1 February, 1951

## THE TOOTHBRUSH*

By **H. COLIN DAVIS**, L.D.S. R.C.S. Eng.

MAY I at the very outset say a word about nomenclature. Just as parodontal has been replaced by periodontal, I would put in a plea that in the future the toothbrush should be replaced by the mouthbrush—it is a term used as far as I know by relatively few periodontists. I doubt if we shall ever persuade a stubborn and conservative populace to accept the word, but let *us*—and perhaps even more the manufacturers—have the concept of the mouthbrush rather than the toothbrush constantly before us. It is certainly a term we should use to our patients, for it immediately emphasizes to them the wider function of the brush, and weakens the mental picture of the scrubbing and scouring of the teeth surfaces only which is conjured up to the average layman by the word toothbrush.

I do not propose to deal at any length with the early history of toothbrushes, and I will spare you the folklore and the ancient Egyptians, nor will I describe the wide variety of toothpicks and toothsticks which have been used by many races from the earliest times. But you must forgive me if I quote again a passage from one of Lord Chesterfield's letters to his son, written in 1754. It contains some admirable and enlightened advice and one terrible heresy. He writes: "I hope you take great care of your mouth and teeth, and that you clean them well every morning with a sponge and tepid water besides washing your mouth carefully after every meal. I do insist upon your never using those sticks or any hard substance whatever which always rot away the gums and destroy the varnish of the teeth".

That was before brushes were used, and it is not until the end of the eighteenth century that they came into anything like general use even among the well-to-do.

As Robert Addis (1939) points out in an article in the *British Dental Journal* on the history of the toothbrush, it was not until the discovery in 1791 of a method of manufacturing soda from salt cheaply, which led to the production of soap for the masses, that the dawn of modern hygiene began, and it was a very protracted dawn at that.

References to toothbrushes and their value in oral hygiene begin to appear with some frequency in the dental literature of the early 1800's. This is well documented in Hirschfield (1939) and I will only make one further quotation: John Fuller's *A Popular Essay on the Structure, Formation, and Management of the Teeth*, London, 1810, has this sound advice on oral hygiene:—

"The teeth should at least daily be cleaned with a brush and water; for this purpose the brush should be stiff, the bundles of hairs not standing close together, but at such a distance and of such a length as to admit a considerable degree of elasticity when pressed on."

The brushes varied enormously in design, but were for the most part made with hand-carved bone or ivory handles, and bristles drawn into holes bored in the head and secured

* A paper read before the Society at the London Hospital Medical College on Dec. 11, 1950.

by wires. By the middle of the century they were being made on a more extensive scale in most countries in Europe and America.

The discovery of celluloid, leading to its commercial use in this country in 1877, resulted in cheaper manufacture and faster output, while the development of the industry in Japan, with its abundant and cheap labour, further reduced costs prior to World War I.

Quoting from Addis's article written in 1939: "By this time the spread of popular hygiene and the development of the modern diet made toothbrushes an essential toilet need of all who could afford them, but their cost was still too high to enable the great bulk of the people to become regular users, and it was not until after the Great War that, as a result of the invention of high-speed machinery for the production of celluloid toothbrushes, prices at 3d. or 6d. have become available to the working class."

Let us now examine the toothbrush market in this country in a little more detail. By the end of World War I the consumption was not more than 10,000,000 annually, which allows one toothbrush per annum for every five of the population. By 1924 the figure had risen to 15,000,000, of which about half were imported, mainly from Japan.

The imposition of import duties on foreign brushes in 1932 gave a tremendous impetus to the home trade, and the enormous increase of machine-made celluloid brushes over hand-made brushes cut costs of production by some 40 per cent. So that by 1934 the total home consumption had risen to 24,000,000, of which 17,000,000 were home produced.

The figures for 1947 show a home production of 31,500,000, of which 7,000,000 were exported; as there were virtually no imports this leaves a total figure for home consumption of 24,500,000.

From 1939 to 1947 the annual consumption remained very constant at about the 25,000,000 mark. It is a little disturbing, then, to find that the 1948 figures are approximately 16,000,000 and those for 1949 18,000,000.

It is too early to assess the significance of this downward trend, and I prefer to take the figure of 25,000,000 as the maximum which the people of this country are prepared to buy in one year.

But I think there are two possible explanations: (1) that nylon toothbrushes have greater lasting qualities and are therefore replaced less frequently; and (2) the increased cost of living. I should value the opinion of our guests on this point.

This is a subject that is full of imponderables and one can only guess rather wildly, but surely this is far too low a figure for the dental health of the nation. I am assuming that we all agree that a mouthbrush is an aid to dental health.

Taking the total population of the United Kingdom as 50,000,000, let us endeavour to subtract the number of people who would not normally use a toothbrush. If we eliminate all children under 2 years of age, and assume that half the population over 45 years of age and the whole population over 60 years of age are edentulous, we are left with a total of 35,000,000. I do not think that this would be a wildly inaccurate figure for the number of potential toothbrush users.

A maximum of 25,000,000 toothbrushes for 35,000,000 people a year—an average of well over a year's life for each brush.

Why is this figure so low? I think possible reasons are:—

1. Oral hygiene has not penetrated yet to the lowest strata of our classless society and there must be an appreciable percentage that never buy and never will buy a brush.

2. The cost of brushes remains high, varying from about 1s. to 2s. 6d. and more, and this price is kept up by the monstrous purchase tax of 33⅓ per cent—but more of that later. The fact remains that when money is tight, a brush becomes a luxury rather than a necessity to many.

3. With inadequate oral hygiene teaching, people become attached to their toothbrushes, which become faithful and well-tried companions, and it may be years before they are reluctantly superannuated. When you stay with friends, do you in the privacy of their bathrooms study their toothbrushes and are you not appalled?

This is probably the most important factor, and further light is shed upon it by two field studies which are worth examining more closely. The first was carried out by Gruebbel and Wisan in the United States in 1948, and reported fully in the *Journal of the American Dental Association*.

A panel of families was selected representing a cross-section of the population resident in cities, towns, and rural areas, and of various age and income groups, throughout the United States.

Each family was asked to send all its toothbrushes then in current use to the Central Office of the American Dental Association, and an order form was enclosed with the letter to the housewife which provided the means for exchanging old brushes for new ones.

The brushes received were examined subjectively by the authors and separated into two general categories: (1) brushes in satisfactory condition and suitable for further use; and (2) brushes in an unsatisfactory condition. The latter were rejected for three reasons: (1) bent or broken bristles, (2) matted bristles, and (3) insanitary conditions.

The findings were as follows: 8176 brushes were submitted by 1929 families, an average of 4·2 brushes per family. The average number per family was just under four, so it was assumed that each member of each family possessed a toothbrush.

19·3 per cent were found to be satisfactory, and 80·7 per cent were in need of replacement because they could no longer be effective implements of oral hygiene or because their use might injure dental tissues. Bent or broken bristles were found to be the most frequent cause for rejection. It is not, however, stated in the report the percentage of nylon and bristle respectively.

Twenty-five per cent of the brushes were considered insanitary because of caked dentifrice and food debris at the base of the bristles, and the authors very rightly use this fact to stress the need for more emphasis on the care of the toothbrush in dental health education.

The second study was carried out in this country very recently with the most valuable help of Miss E. M. Gregg, a member of your Society. We lowered a very much smaller bucket into the ocean, but the findings are not without value. Miss Gregg is dental surgeon to the Carreras Factory, where some 3000 men and women are employed in the manufacture of cigarettes and pipe tobacco. Over a period of six weeks she asked any patients who reported for treatment to bring with them their toothbrush, regardless of its age, when it would be replaced free of charge by a new one. The brushes were then examined by Miss Gregg and myself in a similar manner to that of the American experiment.

The panel of patients covered a wide range of ages, and a proportion of females to males of three to two, but it is, of course, representative of only one social group—though a large one—which in my old-fashioned way I still refer to as the upper working class.

We were as lenient as possible in our examination, and our findings were as follows:—

The brushes examined numbered 288, and of these 17 per cent were bristle and 83 per cent nylon.

47 per cent were rejected as quite unsuitable for further use in the mouth.

23 per cent, though showing signs of wear, were considered capable of some further use.

30 per cent were considered satisfactory.

These figures are bad enough, but not so bad as in the American survey for two probable reasons: (1) I think we were more lenient. (2) It is a well-established fact that the peak buying period for toilet articles is immediately before the summer holiday season. As this survey was undertaken immediately after the holiday season it is likely that quite a number of annual replacements had just been made.

The patients were also asked their preference for hard, medium, or soft bristles—48 per cent preferred hard or extra hard, 46 per cent medium, 6 per cent soft.

I hope that I have now established for you the fact that too few members of the public use toothbrushes at all, and that too many use them long beyond their effective life.

I cannot establish the fact, but few would disagree further, that a very large number of

these brushes are wrongly designed and unsuitable for the unfortunate mouths in which they are used.

The onus is upon us if this state of affairs is to be improved. Let us therefore now examine the broad requirements of a mouthbrush approved by the majority of the profession and acceptable to the majority of the people.

The first essential is to examine the relative merits and demerits of bristle and nylon. We cannot kick against the pricks. Nylon has come to stay, nylon toothbrushes are bought by round about 70 per cent of the population, and nothing we can do will stop them. It is up to us in this society by research and inquiry to see to it that nylon mouthbrushes of such quality are available that they *can* be recommended to the public.

We may still recommend to our wealthy dowagers that they use superb quality bristle brushes with high-sounding names and appropriate prices. But the Churchillian broad masses will go on using nylon, and, until we tell them not to, they will go on using it the *harder* the better.

Consider for a moment where most of them buy their toothbrushes. Many millions a year are sold in the great multiple stores. Penetrate for yourselves one wet Saturday afternoon the red and gold portals of your local store, where in our youth nothing over sixpence was for sale. Fight your way through the steaming mob only as far as the very first counter, where you will see fully displayed a very wide selection of toothbrushes and every known and unknown dentifrice. Watch the cautious purchaser rubbing his thumb over the bristles to make sure that they are good and hard before he puts down his well-earned money. What an opportunity lies here for a joint campaign between ourselves and the manufacturers to influence, by simple propaganda methods, this great and gullible public.

Let us not forget, then, the broad masses. With great humility, Mr. President, I do feel that the only danger into which this admirable Society may run is to forget their needs, and the needs of the thousands of ordinary hard-working dental surgeons who minister to them.

It is no good telling them to spend two hours scaling every mouth, followed by a little bite rehabilitation, with the pious hope of a fatherly nod of approval from Eastbourne. Far better that we should lead the way in producing a mouthbrush which will be a real instrument of oral hygiene in the home care of the mouth.

Bristles are derived from the long hair growing on the back and neck of the hog. Their quality depends on the age of the animal and the geographical location and climate in which he lives. In general, the older the animal and the more rigorous the climate the finer the quality of the bristle.

The finest bristle in the world comes from Siberia, where the extreme climate encourages a protective covering of bristle with a high oil content. Hogs are also reared throughout China, the finest, second only to Siberian, coming from the province of Chunking.

The hogs, unlike sheep, are grown primarily for their food value, and secondarily for their bristle, which in addition to its use in toothbrushes has to supply the enormous demands of all other types of brushes.

China supplies about 56 per cent and Russia 20 per cent of world production at present, India producing 10 per cent of an altogether lower quality.

The supply of good-quality bristle remains limited, and its cost high, and this, moreover, has to be paid for in foreign currency.

But there is a further disturbing factor which may influence future supplies. Up to the Communist revolution supplies from Siberia were considerably higher than they are now, and this for a very good reason. Before the revolution it was a country of peasant smallholders whose dearest possessions were their few livestock and their small quota of hogs. They bred from them, they were a vital source of food in the long winters, they were honoured members of the family circle. Anyone who has travelled even as far as Italy will know what I mean. When they were finally slaughtered, having survived the rigours of many Russian winters, they produced bristle of high quality and in considerable quantity.

The Soviet system of collectivization of farms, with its planned policy of quick food production—a short life and a communal one—radically altered this position, greatly reducing the supply, although the terrain and climate remain ideal.

The old peasant life still goes on in China, which is now the chief source of supply, but the red star is ominously bright over that great country and the same thing may well happen there.

Let me repeat—good quality bristle is in short supply and very expensive. What are its advantages and disadvantages?

The outstanding advantage that is claimed for bristle is that it is not damaging either to the enamel or to the gum margins in any reasonable degree of hardness. Secondly, that it does not fatigue in the way that nylon does, but breaks and is therefore more likely to be discarded before it has become useless or even harmful.

It is important to remember that it is an organic substance and that it absorbs moisture. It therefore becomes softer in use, and unless kept scrupulously clean is liable to become permanently infected.

Its chief disadvantage, apart from scarcity and high cost, is that it has no scientific standard of quality or degree of stiffness.

The quality depends upon (1) the age and location of the animal, (2) the degree to which the bristle has been bleached, and (3) the skill with which it is cut and trimmed.

The degree of stiffness depends on the part of the bristle used—the nearer the root of the hair, of course, the stiffer the bristle—the bristles varying in length from 2 to 6 inches. Degrees of stiffness from soft to hard are obtained by the blending of two or more cuts. A bristle brush made by a firm with a reputation for quality, employing skilled workers and using the highest quality material, will no doubt remain, at a price, the mouthbrush of choice. But it cannot begin to satisfy the needs or the purses of the majority. Bristle brushes which are cheaply produced, but which absorb moisture easily, break quickly, and are badly trimmed, are no answer to the problem.

We must, then, consider nylon, the only recognized synthetic substitute for the natural product.

The nylon filament used in toothbrushes is obtained by melting the polymer at 246° C., and from the molten polymer the smooth solid monofilament is made by forcing it through holes in a steel plate into a tank of water, where it solidifies. The diameter of the filament is exactly governed by the size of the holes in the steel plate.

The solidified filament is wound off on reels like cotton thread and when cold is stretched, whereby the molecules are orientated to occupy a regular arrangement or pattern which confers greatly increased tensile strength upon the filament.

Here, then, we have a substance produced in hygienic and controlled conditions and having an accurately determined diameter. A scale of diameters has been worked out and agreed between the British Brush Manufacturers, based on thousandths of an inch.

There are four specifications:—

1. Soft, 0·009 of an inch or less.
2. Medium, 0·011—0·012 in.
3. Hard, 0·013 in.
4. Extra hard, 0·014 in.

Macfarlane (1945) has gone into the matter more deeply and devised a formula for determining with great accuracy the standardization of stiffness of filaments—whether bristle or nylon—depending upon the relationship between the diameter, the length, and the modulus of elasticity or degree of bending of the material. We may sum up the advantages of nylon as:—

1. It is plentiful, relatively cheap, and produced in this country without the need for foreign currency.
2. It has a uniform diameter which can be accurately determined and graded to suitable degrees of stiffness.
3. It does not soften in water or absorb moisture to anything like the same extent as bristle.
4. It does not break.
5. It looks cleaner, and not being subject to biological attack is more easily washed and kept clean.

The disadvantages appear to me to be:—

1. If used in too high a degree of stiffness, it is harmful both to the enamel and to the gum margins.

2. It does not break as bristle does, but fatigues and becomes bent and twisted.

An attempt has been made to overcome its possibly excessive abrasive action by rounding the ends of the nylon filaments either mechanically or by heat treatment. This has been done by a number of manufacturers. It is also done gratuitously by the user of the brush over a comparatively short period of time.

A valuable piece of research bearing on this problem was carried out in the States in 1948 by Robinson and Kitchin at the Ohio State University, and incidentally financed by the Prophylactic Toothbrush Co. I quote from their first and very significant paragraph: "The toothbrush is used to massage the gingivæ as well as an aid in cleansing the accessible surfaces of the teeth. It has been generally conceded that the massage of the gingivæ stimulates the circulation of the blood in the fibrous subepithelial layer and thus aids in maintaining gingival health. It has been shown that massage, applied over a period of time, will cause the surface layer of epithelium to become keratinized in man."

This surely is an admirable definition of the role of the mouthbrush in oral health.

For their experiment the authors had a panel of forty dental students, divided into two groups of twenty. Each group was instructed to brush the teeth in their usual manner over a period of thirty days. The professional type of brush was used with 0·012-in. diameter nylon, one group using round-end and the other cut-end bristles.

The gingivæ of the six upper anterior were examined before and after at × 7 magnification with the aid of a wide-field binocular microscope, while biopsies of the upper anterior gingival tissues were taken before and after the experimental brushing in five mouths in each group. No attempt was made to standardize the brushing technique, but the results of the biopsies showed that there did not appear to be any advantage of round-end bristles over cut-end bristles, and that the greater the degree of brushing of the gingivæ the greater the degree of keratinization.

Here, I believe, is an almost virgin field, crying out for research. Practically no work has been done, apart from that just quoted, on the effect of various types of brush on the gum margins either of human beings or animals. I believe that it is by experiment along these lines that we shall ultimately find a brush which will both clean the tooth surfaces and keratinize the gingivæ when used even with a modicum of skill.

There are many more points which I should like to deal with, but I feel to-night that the discussion is more important than the paper, and I shall have to touch on them briefly and leave it to you to pick up the points which you feel need emphasis.

Let us not get bogged down to-night in minute details of design, or allow ourselves to be too influenced by the passionate advocates of their own pet design who regard all other toothbrushes as weapons of evil.

There certainly has been a great overall improvement in design in recent years, for which I think the profession must take a fair share of the credit.

Those vast monstrosities designed for the sink rather than the mouth are becoming rarer, and the small straight head about 1–1¼ in. in length, with three rows of bristles, is generally accepted as the soundest basic design.

I do not foresee any further revolutionary changes in basic design, but more research should be done on the effect of different ways of cutting and trimming the bristle ends, and the ideal number of bristles per tuft and tufts per brush.

I repeat, firstly, the pressing problem is to produce a nylon brush sufficiently hard to clean the accessible tooth surfaces and keratinize the gingival margins without doing injury to either, and, secondly, to persuade the public to use it. At present the public demands a hard brush and its demands are all too readily met.

A whole evening might well be dedicated to brushing methods, and again, like toothbrush

design, it breeds passionate advocates of specialized methods.

No one method can be universally applied, but difficult techniques can only be taught to intelligent patients whose oral conditions demand them.

Few people spend the time or trouble on the cleaning of the teeth and massage of the gums which we consider necessary, and it will take a lot more propaganda than is used at present to alter this.

I believe that it is our duty to advocate one simple method for general use, one which will do the least damage and the maximum good, but by all means let the individual practitioner with the time and enthusiasm teach the methods of Charters or Stillman or anybody else to those of his patients who are prepared to listen to his gospel.

The method so admirably demonstrated in films made by the R.A.F. and Army is generally accepted in this country as the simplest and safest method. The mouth is divided up into twelve sections—the outer and inner surfaces of the posterior and anterior teeth and gum margins in each jaw. Each section is brushed in a sweeping rotary movement from the gum margins over the teeth surfaces.

After completion of all the sections, the biting surfaces are brushed with a scouring to-and-fro movement.

This method can be taught quickly and its object explained to the patient by means of a brush and plaster model. At another visit the patient can be encouraged to bring his toothbrush to demonstrate the method himself in his own mouth, and this affords the opportunity of examining the brush and noting its condition and whether in fact it is fit to be called a mouthbrush.

Let us return for a moment to the question of Purchase Tax. Here we go right through the looking glass into a world of fantasy and the Cripps-like thought processes of the bureaucratic mind.

One assumes in one's innocence that the basic idea behind purchase tax is that it should *not* be applied to articles of necessity, but rather to articles which are extravagant, frivolous, or even mildly indulgent.

Notice No. 78 by the Commissioner of Customs and Excise lays down the details of application of purchase tax.

Group No. 31 deals with toilet requisites, and here we find it laid down that—among many other articles—toothbrushes, toothpicks, and dental sticks shall carry a tax of $33\frac{1}{3}$ per cent.

It is cold comfort to find in the same group that chin straps for correcting double chins and blackhead removers are charged 100 per cent.

But it is monstrous to find that shoe brushes and household brushes are exempt from the tax.

The argument that a toothbrush is not a necessity must be wholly unacceptable to this Society, but viewed from the lowest angle of L.S.D. I believe that this curbing of sales of toothbrushes costs more in dental treatment in the Health Service than the relatively meagre return which this tax yields.

There is one ray of hope—or is it the last flicker of despair?—there *is* one dental item which has been spared—your toothbrush, your dentifrice, your dental sticks stand at $33\frac{1}{3}$ per cent, but there is no purchase tax on dental suction disks.

The matter has, of course, been taken up by the British Dental Association in close consultation with the British Brush Manufacturers' Association.

A lengthy correspondence was carried on between them, the Ministry of Health, and the Treasury, and very strong representations have been made to the Ministries ever since 1946 but without result.

Finally, I would like to suggest five courses of action which this Society might espouse:—

1. The setting up of a small working party to produce, on the lines of the American Dental Association Bureau of Standards, the broad specifications required for acceptable mouthbrush design for general use, and to maintain a close liaison, through the British Brush Manufacturers' Association, with the toothbrush manufacturers.

2. The organizing of a questionnaire by the Society through its working party, to the whole profession on brush design and cleaning

methods, a questionnaire which would be completely disinterested and without commercial bias.

3. To explore the possibility of joint action between ourselves and the manufacturers to promote a campaign in the multiple stores and chemists shops to abandon the use of very hard nylon brushes.

4. The encouragement of research work at one or more of the schools, along the lines adumbrated by Robinson and Kitchin, into the effects of different types of brushes on the living tissues of the mouth.

5. A new, spirited, and more imaginative attack on this wicked tax on toothbrushes and dental sticks.

I wish we had an A. P. Herbert to speak for us in the House, but as a Society, as members of the British Dental Association, and as practitioners, it is up to us to go on fighting.

## DISCUSSION

The President, in thanking Mr. Colin Davis for his very able paper, called upon Dr. Fish to open the discussion. Dr. Fish, in congratulating Mr. Colin Davis, agreed wholeheartedly with the proposal to remove purchase tax, and the suggestion that the toothbrush be called a mouthbrush. He pointed out that so often the brushing as carried out was confined to the teeth and not the gums, and stressed that the filaments, whether nylon or bristle, should remain straight.

Mr. Trotter, replying to a point made in the paper, said that he was continuing some research as to the effect of bristle and nylon filaments of various dimensions upon the gums of dogs. He considered that the majority of the brushes on the market were toothbrushes not mouthbrushes, and that, once the latter had been evolved, the teeth, and particularly the gingiva, could be brushed in any direction without harmful effects.

Mr. Leatherman mentioned an investigation he had carried out into the use made of toothbrushes distributed free in Poplar; it was found that many individuals and families were incapable of making use of the brush as they had no proper sinks or basins; and that it was useless to instil the correct use of the brush into this section of the community until better facilities were available for hygiene as a whole. He spoke a word of warning against red toothpaste.

Mrs. Michaelis emphasized that habits are laid in the nursery, that it was in nursery schools that toothbrush drill should be taught, and that many young children do not even know what a toothbrush is.

Mr. Mcfarlane considered that the agreed nylon scale did not extend low enough. He mentioned a firm whose brushes were graded as soft, extra soft, and extra extra soft. The diameter of this filament was well below 0·009 in. He suggested the manufacturers should consider what might be termed a "utility" brush.

Mr. Room, speaking as a toothbrush manufacturer, mentioned that in his own firm there was a museum with not less than one hundred different patterns of the toothbrush. Now only some twelve or twenty were manufactured. He pointed out that the manufacturers provided what they were asked for, and in the past there had been very little guidance in this respect from the profession and too little instruction and influence by the profession upon the public. He expressed his thanks for being invited to attend the meeting, which he had thoroughly enjoyed.

Other speakers included Messrs. Markham, Benson, and Dr. Bourne.

Mr. Colin Davis, in replying, agreed that teaching must start young. As far as the care of the brush was concerned, he advised keeping two, washing them in running water, and hanging them up to dry. He hoped that any working party formed would consider the need for the very soft brush. He had no knowledge concerning the pathology of any micro-organisms found on bristles.

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